UNITED PROVINCES OF AGRA AND OUDH.

INDIAN IRRIGATION COMMISSION.

MINUTES OF EVIDENCE.

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THE IRRIGATION COMMISSION OF 1901-02.

UNITED PROVINCES OF AGRA AND OUDH.

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Mr. W. B. GORDON (*Secretary*).

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FOURTEENTH DAY.

Allahabad, 21st November 1902.

WITNESS No. 1.—MR. E. W. RICKETTS, Manager, Court of Wards, Rae Bareli.

Mr. E. W. Ricketts.

21st Nov. 02.

1. *Q.* (*The President.*)—How long have you had experience of these parts?—I have only just gone to Rae Bareli, but I have had the managing of Court of Wards Estates for 22 years.

2. *Q.* In what districts?—First in Etah, then in Gorakhpur and Barabanki.

3. *Q.* Have you had much to do with introducing well irrigation?—Yes, in all three districts.

4. *Q.* How much irrigation appertains to a good well in an average year?—It would command 30 or 40 acres in a season.

5. *Q.* How much will it actually water in the course of a year? A great part will be twice watered. How many acres of crop can you take off it?—About 25 acres.

6. *Q.* What depth of water does that allow for?—That makes the difference. The depth of water varies from 20 to 30 feet below the surface.

7. *Q.* With how many pair of oxen?—With ordinary wells they work two buckets. Each bucket has one pair of oxen. I do not say that the whole 20 acres watered will belong to one man, or that one man's bullocks will be working all the time. There may be half a dozen pairs of bullocks belonging to different men.

8. *Q.* Do you find that there is much dispute among the people about a well? Does a well belong to one man, or are there shareholders?—It either belongs to the landlord or to one tenant. I have very seldom seen an instance where two or three own a well; but everyone is allowed to use a well.

9. *Q.* Do they pay?—No, but the owner has first choice.

10. *Q.* They do not fight over it?—I have never seen any disputes.

11. *Q.* What does one of these wells cost?—Perhaps they would have to carry down to 40 feet before touching the clay; one such would cost Rs. 250.

12. *Q.* How many years would that last?—Thirty or 40.

13. *Q.* (*Mr. Muir-Mackenzie.*)—Is there any reason why it should not last for ever if it is properly kept up?—If it is carried down to a proper foundation, it will last any number of years. If the foundation gives way, the well falls in.

14. *Q.* (*The President.*)—Is there much doubt as to the selection of a site? Are there bad shots made?—Yes. But we make expensive wells systematically in the Court of Wards. We take trial borings, and we are careful in selecting the site in the first instance.

15. *Q.* Do you find that you have to take two or three borings before you strike on the right place?—Yes, four or five sometimes.

16. *Q.* What are the points that make you reject a site?—The main object is to get a good firm foundation or *mota* for the cylinder. If we get down 50 or 60 feet—that is prohibitive, the cost is too much.

17. *Q.* Would you occasionally find the *mota* 40 feet deep in one place and 30 feet only two acres away?—Yes. In one village can be found two or three varieties.

(*Mr. Roberts.*)—There are instances where the well is twenty yards off.

18. *Q.* Would you advise that at head-quarters there should be boring materials available to help the agricultural classes?—It would be a great help and the Land Records Department has within the last year introduced that system. They have a practical man, a Roorkee overseer, Ahmad Hosain. He has done a lot of well sinking and is a most excellent man.

19. *Q.* Is he available to go from one district to another?—Yes, any zamindar can have his services by paying a fee of Rs. 10, and he takes boring tools from the Land Records Department and makes as many trial borings as necessary and looks at old wells.

20. *Q.* Is it generally known?—Leaflets have been issued broadcast among the talukdars by the district officers.

21. *Q.* Is there only one man of this sort for the whole of the provinces?—Only one at present. He is the only man I have met who knows anything of the subject of the practical working of wells.

22. *Q.* A zamindar who applies to the department can have his services?—Yes.

23. *Q.* To make the thing generally useful more than one man is wanted for such a large country as this?—Yes.

24. *Q.* Should one man be in each district?—He would not have enough to do; but one to each division would be a great help.

25. *Q.* Have you had much experience of zamindars applying for *takavi* advances for wells?—My own experience is wholly of tenants; they are always asking for them. We always help them as far as we can.

26. *Q.* Do you spend large sums in that way?—Yes; we take 6¼ per cent. interest on our advances.

27. *Q.* (*Mr. Muir-Mackenzie.*)—What is the largest sum you have given on any one estate in one year?—Rs. 3,000 or Rs. 4,000. That includes seed and cattle. Most of our estates are generally so insolvent.

28. *Q.* (*The President.*)—Had you canal irrigation in your estates in Etah?—Yes, nearly all canal irrigation, the Lower Ganges and Upper Ganges. But they used to build wells there too, where the canals did not go.

√29. *Q.* Did you form the opinion that the soil had deteriorated on account of the irrigation; that *reh* or *oosa* lands had increased?—It is 18 years since I left those parts.

30. *Q.* What is the irrigation in Gorakhpur?—Tanks and wells. Water is closer to the surface there than in Oudh.

31. *Q.* Have they small private canals taken out from the streams?—Those have only been made by the grantees up in the north, Mr. Bridgman and Mr. Pepye. They have a regulation system of canal irrigation and we tried to copy them in Court of Wards Estates. We dam up a lot of little streams and natural depressions and form reservoirs with sluice gates.

32. *Q.* The irrigation there is chiefly rice, I suppose?—Yes, and wheat in the *rabi*.

33. *Q.* Do native zamindars adopt the same means as the grantees?—They have not much enterprise on those lines.

34. *Q.* Were you up there in the famine time?—I was in the Barabanki district in 1896-97.

35. *Q.* Was it felt there to any extent?—Not so severely as in other parts of the country.

36. *Q.* Barabanki is all well irrigation?—Yes, and tanks. No canals.

37. *Q.* (*Mr. Muir-Mackenzie.*)—In places where you made these wells did you get any increased rent?—Yes.

38. *Q.* At once?—As soon as the well comes into use.

39. *Q.* By agreement with the tenant?—Yes.

40. *Q.* Had you any difficulty in securing enhanced rent?—No.

41. *Q.* And then you got an exemption, I suppose, from an increase in assessment?—No.

42. *Q.* Were your wet lands assessed at the wet rate at the next assessment?—I suppose so. We got no concession on the Barabanki estates. At least we knew nothing about it if any concession was given. In Gorakhpur we asked for concessions.

43. *Q.* Did a revised settlement take place in your time?—In Gorakhpur and Barabanki. In Gorakhpur the grantees asked that the capital spent on improvements might be taken into consideration and they got some concession, I think; but I do not know for certain whether concessions were given in Court of Ward Estates or not.

44. *Q.* You are not sure that they were not?—No.

45. *Q.* (*Mr. Roberts.*)—The chief wells were in Dumri estate?—Yes.

46. *Q.* Was not the settlement made before you built your wells?—It was going on. There were very few built before the settlement. The wells built in my time were built after the settlement.

47. *Q.* Were not Mr. Kennedy's wells brought to the notice of the Settlement Officer?—Yes; but I cannot remember whether we got any concession or not. The other landlords, Mr. Pepye and Mr. Bridgman, who spent large sums of money on irrigation works, I know, got some concession.

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48. *Q.* (*Mr. Muir-Mackenzie.*)—When you made the wells you thought it quite possible that the assessment on the well lands might be raised?—I did not think about it one way or the other.

49. *Q.* Then if it had been raised, would it have been worth while to make the wells?—Yes.

50. *Q.* Are many wells made by your tenants?—Every year.

51. *Q.* When they make wells do you get an increased rent from them?—Not if they build the wells at their own expense and without any assistance from us.

52. *Q.* In the latter case, even if they have paid back the advance with interest, do they have to pay an increased rent?—I do not, as a rule, take any increase from a tenant who sinks a well at his own expense; only where we assist him.

53. *Q.* Do other zamindars take enhanced rents?—Yes.

54. *Q.* (*Mr. Roberts.*)—But explain the nature of the assistance. It is not merely advances of money; is it?—We give them all the fuel to burn their bricks and wood for the well curb.

55. *Q.* (*Mr. Muir-Mackenzie.*)—In virtue of your assistance you feel entitled to take the increase of rent?—Yes.

56. *Q.* Does that assistance cover all the expense that the tenant incurs?—He has no expense besides the making of the bricks and masonry and the sinking of the cylinder.

57. *Q.* What increase do you get; the full wet rate?—We take the legal enhancement in Oudh—one anna in the rupee.

(*Mr. Roberts.*)—In the North-West Provinces there is a strict occupancy tenancy in which enhancement can only be made according to law. In Oudh there are no occupancy tenants at all, and all the occupancy tenants there are not occupancy tenants in the same sense. They are a different class of men. The ordinary tenant in Oudh had no tenant right at all until the new Act. The Oudh Act made a provision to protect them, providing that when a tenant cultivated land or held it for seven years without being ejected, the landlord could either eject him at the end of seven years or raise his rent one anna in the rupee, but not more than that. That is what is referred to.

(*The President.*)—And he insists in all cases that the tenant should either pay an extra anna or go?

(*Mr. Roberts.*)—Yes, but he has to pay compensation for improvements. The tenant cannot resist the ejectment.

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58. *Q.* (*Mr. Muir-Mackenzie.*)—If a landlord makes a well, does he still get only one anna in the rupee?—For improvements we can get a higher enhancement than one anna in the rupee under section 49. To take a higher enhancement is agreed to between the parties.

59. *Q.* Do you consider that such enhanced rent as you have been able to get has paid you for your outlay?—The Court of Wards are content if they get interest on their money. We do not seek to get back our capital.

60. *Q.* As regards wells made at your own expense?—Yes.

61. *Q.* You would expect to get the interest in the shape of enhancement of rent?—Yes.

62. *Q.* What do the other landlords do?—They try to get back the whole of their money.

63. *Q.* And the tenant does not generally object to this moderate enhancement equivalent to interest on the money?—They are very willing to pay it to get the well.

64. *Q.* What is the character of the boring machinery of the Agricultural Department? Is it very elaborate and expensive, or just a country machine?—In the Barabanki district I bought two sets at between Rs. 400 and Rs. 500 a set.

65. *Q.* Is there any country system of boring with cheap machines?—No.

66. *Q.* With your machinery how many wells could you bore for in a season?—The operation takes a few days only. Sometimes if the site is a suitable one, we proceed to build our wells.

67. *Q.* That means you would not get through more than two wells a month with an average of two or three borings for each well?—At least four wells a month.

68. *Q.* About 30 wells a year?—Yes, with one set of tools.

69. *Q.* Do the tanks dry up in Gorakhpur in a year of drought?—Yes.

70. *Q.* And how do the wells last?—The spring level drops, but the supply of a good well holds out.

71. *Q.* In a dry year a well serves you better than a tank?—There is no comparison between the two.

72. *Q.* Are the tanks made by *bunds* thrown across depressions?—That is one way to form reservoirs. But the ordinary tank is just dug.

73. *Q.* And the latter are used for irrigation?—Yes; it is the most popular means of irrigation, because it is the cheapest apart from canal tracts. Where there are wells even the first waterings will be always done by tanks, and when the latter are exhausted, they resort to wells.

74. *Q.* Is the spring level in the neighbourhood of tanks higher than away from them?—Certainly.

75. *Q.* Do the tanks silt up?—Yes; we are always deepening out tanks.

76. *Q.* Does that pay?—Yes.

77. *Q.* (*Mr. Roberts.*)—Have you done that except as a famine work?—Yes, in ordinary years too.

78. *Q.* (*Mr. Muir-Mackenzie.*)—Do you also deepen the reservoirs behind the *bunds*?—Yes.

79. *Q.* You do not prefer to raise the *bund*?—We cannot raise it beyond a certain limit; we should flood the land at the back.

80. *Q.* Are the people on these estates always keen to get advances for wells?—Where money is available on the estates they are keen enough, and we often have to refuse when we have run short of our allotment when the estate is in debt. When we cannot give cash advances we are always ready to help them in other ways with fuel, etc.

81. *Q.* You would like to have larger cash allotments if they could be made?—If money were available, we could find use for it.

82. *Q.* (*Mr. Rajaratna Mudaliar*).—Have your tenants to pay *salaami* to the landlord before they get permission to dig a well?—Not in the Court of Wards.

83. *Q.* But what is the custom?—I have not heard of it here.

84. *Q.* Do the tenants construct wells even without asking permission?—No.

85. *Q.* You said a fee of Rs. 10 is to be paid for the boring instruments. Would the landlord hope to have any number of borings he liked for that fee?—For that fee he gets the advice of the well expert of the Agricultural Department, who gives an opinion on new sites and on old wells that have gone wrong. The fee is for each visit, which may be utilised to give an opinion on more than one well.

86. *Q.* Suppose the landlord wants 50 different sites?—That would be unreasonable, but I have had the expert inspect something like six different sites for one fee—wells built by the Court of Wards in previous years which had gone wrong. He gave an opinion on each well.

87. *Q.* Do the tenants avail themselves of the services of the expert?—He has only recently come into existence; some zamindars of the Barabanki district got him, but the tenants have not gone so far as that yet.

88. *Q.* Will not tenants regard this fee as excessive?—Probably.

89. *Q.* Do not the ordinary people use an iron rod to test whether the soil is suitable; a rod about 14 or 15 feet long?—When they have carried their well down to a certain depth and have not struck water, they do not sink any further, but pierce a hole in the *mot*, perhaps to four or five feet, and tap the spring that way.

90. *Q.* (*The President.*)—That does not tell anything of the future supply?—They get no information; it is simply to get at the state of the soil; how thick the *mot* is and what is at the bottom of it.

91. *Q.* (*Mr. Rajaratna Mudaliar.*)—Did you get any loans from Government under the Lands Improvement Act for the estates you were in charge of?—If the estate is solvent, it uses its own money. If we want the money, we can always get it.

92. *Q.* (*Mr. Muir-Mackenzie.*)—The Government will not advance to a deeply indebted estate, I presume.

(*Mr. Roberts.*)—Not unless there are special reasons.

93. *Q.* (*Mr. Rajaratna Mudaliar.*)—Why does the boring sometimes take a week?—They have to drive a hole into the ground down to the water level. Sometimes they have to dig down 20 feet. Then they start boring operations from the water level. Sometimes, if they strike a rock, they might be stuck 15 days; that is to say, beds of *kunker*, not rock.

94. *Q.* (*Mr. Muir-Mackenzie.*)—Do you generally grow cereal crops under the wells?—Yes, principally *rabi* and sugarcane.

Mr. E. W. Ricketts.

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95. *Q.* You use a good deal of manure for the crops irrigated by wells?—The cultivator puts on as much manure as he can get.

96. *Q.* Not having manure does not prevent him from irrigating?—No. The whole of the *rabi* has to be irrigated practically.

✓97. *Q.* Have you formed any idea as to the possible limit of the number of wells in any given neighbourhood. Would there be any danger of exhausting the sub-soil water or lowering the spring land if you attempted to put in a well for every 20 acres?—I have never had wells so closely grouped in any part.

✓ 98. *Q.* Then if the numbers were doubled?—I do not think it would make any difference; the number of wells is always increasing. The cultivators dig *kachcha* wells almost every year, and they fall in again.

✓ 99. *Q.* Do they ever come to as many as one well to 20 acres?—No.

100. *Q.* And one well does not rob another?—No.

101. *Q.* You never find the people reluctant to make wells. Everybody is exceedingly keen?—Yes.

(*Mr. Roberts.*)—You said there is no difficulty about getting enhancements when a zamindar builds the well, but I do not think that can be put down as universally correct. Have you not had difficulties in getting enhancement?—We do not build wells entirely for the sake of enhancement; but we have no difficulty in getting 6¼ per cent.

102. *Q.* Do not you know of an instance where the tenants, rather than pay an enhancement, refused to take the water?—Yes, we had some cases in Dumri estates.

103. *Q.* What was the reason in that case?—It was partly that the sites were not very carefully selected. The tenants said they could have their own wells and other means of irrigation, and the wells were expensively built. They cost Rs. 1,000 and Rs. 1,200 and the interest on that came to a lot.

104. *Q.* But the enhancement subsequently obtained was equal to the interest on the outlay?—I think so.

105. *Q.* Do you know of a feeling among native landlords against the making of wells by tenants?—Yes, unless they enter into agreements about compensation.

106. *Q.* They want to know what compensation the tenant will claim at the end of his tenure when he is going to be ejected. They settle the terms beforehand?—That is in Oudh.

107. *Q.* In other words, they do not give the tenants permission to dig wells so freely as the Court of Wards?—I may say they do not encourage them very much to build wells.

108. *Q.* The landlord cannot turn a tenant out without paying compensation for improvements. That leads to litigation. The natural course is for the tenant to claim ten times what his improvement is worth and the landlord to put it at half; and it is a troublesome thing to decide. It is difficult to value a well when it is built, and rather than subject himself to a claim that might be passed by a benevolent Deputy Collector, the landlords like to guard themselves by taking an agreement from the tenant that the cost of the well was only to be put at a certain sum, and that he should not be allowed compensation for it if he keeps the fields for 10, 15 or 20 years. I have seen agreements like that.

109. *Q.* (*Mr. Muir-Mackenzie.*)—Are these valid?—The old ones were. An agreement as to the value of the compensation would be valid.

110. *Q.* (*The President.*)—You have said that the *rabi* was entirely dependent on irrigation. I suppose there is a great deal of *rabi* grown with the rain in Barabanki?—The *rabi* started with rain in October gets on all right, but there is no *rabi* that practically comes to maturity without irrigation.

111. *Q.* (*Mr. Muir-Mackenzie.*)—I understand you had a practice of making wells through selected tenants?—Yes.

112. *Q.* You found that when you made them through contractors they were too expensive?—When we built them ourselves they were more expensive.

113. *Q.* What is the system? You give the tenants some money?—Yes, and fuel for bricks, and whatever wood is required for the *kerb*, and a sum of money.

114. *Q.* You supervise the building?—Yes; that is the system Court of Wards has recently introduced, and it is much better than building expensive wells through contractors.

115. *Q.* That money is not a mere advance, because the well remains your own?—Yes.

116. *Q.* From time to time it has been suggested that Government should make wells, but one of the principal objections is that it is very expensive. If Government adopted some such method as yours, would it be able to make wells less expensively?—Yes, but to whom would the well belong?

117. *Q.* To Government. This is as an alternative to the *takavi* system?—What return would the Government expect for the money laid out?

118. *Q.* I was coming to that. You do take return?—Yes, our 6 per cent.

119. *Q.* And the tenants are perfectly willing to encumber themselves with that increase of rent?—Of course. The suggestion I might make would be that Government might put upon the land a sum sufficient to carry interest on the money.

✓120. *Q.* You had a good deal of ordinary irrigation work on the Court of Wards estates in the famine?—Yes.

✓121. *Q.* What did it principally consist of?—Deepening existing tanks and clearing out silt.

122. *Q.* You got a good deal of increased irrigation out of that?—In subsequent years.

123. *Q.* (*Mr. Rajaratna Mudaliar.*)—When the wells are constructed with estate money by tenants, who is responsible for their up-keep?—The estate.

124. *Q.* Do you generally employ the tenants of the lands in which the well is to be sunk?—Yes, the tenant himself comes forward and says that he wants to have a well in his holding, and that is the man who gets the money.

125. *Q.* Does he contribute any portion of his own labour?—He may. It often happens that he spends a little of his own money too.

126. *Q.* Do you take that into account?—We only get interest on the actual money given, and we do not take into account the material supplied—only the cash.

Witness No. 2.—Munshi Alam Ali, Deputy Magistrate, Fatehpur Division, Lower Ganges Canal.

Munshi Alam Ali.

21st Nov 02.

(*To the President.*)—I have been investigating the possibility of canal irrigation in Mirzapur. There exist good facilities for irrigation, chiefly *kharif*. In a year of good rainfall the people will not take water except for *paleo* of *chena* and *alsi* at end of rains. Very little wheat is grown. Rice and *kodo* in the *kharif* are the only crops. The rice is inferior and could pay very little. Government will get no return except in dry years from saving in relief. On the Belan on the first 14 miles there is not much hope of demand for water except for rice in dry years. I do not know the Shahabad district. There is a great deal of *mar* on the Belan for the first 14 miles which produces *rabi* without irrigation except in very dry years. In ordinary years this soil, if irrigated, is attacked by rust and other diseases. We grow rice in the *mar*. Below 14 miles half the soil is *mar* and half of a lighter description. Wheat is grown in *mar* soil only and very little even there. Rice is the chief crop; there is very little *reh*. In the Karamnassa half is black soil and half other kinds of soils. All of them want water. Many tanks have been made in the Karamnassa tract, but very few in the Belan. There have been no signs of irrigation from the tanks which were made in the famine. The famine was very severely felt in our part of the country. The cultivation is poor both on the Belan and Karamnassa.

Witness No. 3.—Mr. J. McCallum Wright, Collector of Cawnpore.

Mr. J. McCallum Wright.

21st Nov. 02.

1 *Q.* (*The President.*)—How long have you been at Cawnpore, Mr. Wright?—About eighteen months; but I was there once before as Joint Magistrate for about two years.

2. *Q.* What other districts have you been in?—I have been in a good number of districts. I have been in Ghaziabad, Muttra, Basti, Gorakhpur, etc. I have been pretty well all round the province.

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3. *Q*. You were not at Cawnpore during the last famine in 1896-97?—No, but I was at Etawah, the next district.

4. *Q*. Then perhaps you could speak for Etawah as well as Cawnpore?—I think I may be able to speak for them both.

5. *Q*. Do you think for either one or the other much more is necessary to protect them from famine in the future?—I have brought you a map of Cawnpore and you will see from it that Cawnpore is thoroughly well protected. There is one canal running right down here; there is another canal round here; there is a third one running down here; there is a fourth one running there and a fifth one running there (indicates them on the map). There are five canals in all; I do not see how you could get another canal in there. Etawah is fairly well protected except across the Jumna, where nothing can be done.

6. *Q*. We have had in our enquiries to go into the question of *takavi* advances for wells a great deal, not for other improvements. We have asked questions about them in every district we have been in, and we found that there was a very general feeling that the people do not know that they can have them, or if they do know, they do not like to take them. We also heard that in some places they were not availed of, and in other places they were greatly availed of. What is your experience?—I think they all know about it. In some districts they do avail themselves of it, and in some districts they do not; in some districts they are made to avail themselves of it.

7. *Q*. You mean it is pressed upon them?—Yes. The only objection that they have to taking *takavi* is that the underlings at the tahsils take so much. I should prefer to send the money to them by money order, if one could.

8. *Q*. (*Mr. Muir-Mackenzie.*)—Could one not?—I suppose one could very easily, if the Board authorised him to do it.

9. *Q*. (*The President.*)—Should there be a special officer for this purpose in every district, and with a bag of rupees to go about and start this?—I don't think he will do any good.

10. *Q*. We were told that the Collector had a great many other things to do besides attending to this; and that although it was an excellent thing to multiply irrigation wells, it could not be done, because nobody had any time to attend to it?—I don't think so. I have never found that in my experience. It would only be the case if the applications were very numerous.

√ 11. *Q*. Has the Collector enough money at his disposal always except in times of famine?—That is another question altogether. I have never had to refuse an application yet, because there was not enough money.

√ 12. *Q*. You say in some cases it has been forced upon the people. Is that due to the over-zeal of the tahsildars?—Yes. When I use the word "force" I don't mean to say that anything illegal is done. The tahsildar goes about and gets the zamindar to take money for wells.

√ 13. *Q* (*Mr. Muir-Mackenzie.*)—Does he persuade him legitimately? Does he get him to see the advantage of it?—You could hardly go so far as that, but he does not use illegitimate means.

√ 14. *Q*. (*The President.*)—A little parental treatment, I suppose?—Yes. A little moral suasion.

15. *Q*. (*Mr. Roberts.*)—There is no discrimination used when a man applies for money for a well; is there? There is no enquiry as to how much money is necessary to build that particular well, or is the zamindar's estimates about his requirements accepted?—In a district pretty much the same amount is given for each well.

16. *Q* You mean there is a district figure?—Yes. If there is anything above that or below that, I would enquire into the matter. For instance, if a man sends an application wanting a thousand rupees for a well, then I would make enquiries into that.

17. *Q*. Except a general idea has the Collector or tahsildar sufficient material to judge what it should cost?—Not accurately.

18. *Q*. (*The President.*)—Have you known many cases where the security has been bad and the *takavi* advances have not been recovered?—I have known one case only.

19. *Q*. Is there any objection made to the rate of interest, 6¼ per cent. being too high?—No, but objection is made to the punctuality with which we insist upon getting our money back.

20. *Q*. How many years do you generally grant them for repayment?—I consider the applications, and if the request is only for a small well, the applicant finishes it within the year; if not, two years; but I have known the case of a man who has had the period extended to three years.

21. *Q*. You don't extend the period of repayment to anything like over twenty years?—No; I think I am right in saying that we never give more than three years for repayment. I have never given more than three years myself.

(*Mr. Roberts.*)—The law limits to 30, I think.

22. *Q*. (*The President.*)—Do you think that the loans would be encouraged if there was a longer time allowed before the increased assessment was levied upon the land watered?—I don't think it would ever appeal to the zamindars or *kashtgars*. They never look so far forward as that.

23. *Q*. But if it was for ever?—I don't know what influence it would have if it was for ever.

24. *Q* (*Mr. Muir-Mackenzie.*)—Do you think they would understand it?—I don't think they do. They don't trouble about it.

√ 25. *Q*. (*The President.*)—Have you seen frequent cases of land deteriorated by canal irrigation?—No.

√26. *Q*. Not *reh*?—Not very much. I was on special duty in Muttra to enquire into that, but I found very little deterioration indeed. I have known cases in Cawnpore where there has been a certain amount of deterioration. The people themselves declared that there was a great amount, but I found it was not due to canal irrigation exclusively.

√27. *Q*. It was due to heavy rainfall?—Yes, as much as anything else. As far as I could ascertain, the canal was not responsible to any great extent for it.

√28. *Q*. A good remedy for it is said to be drainage. Have you found instances where lands have gone to the bad and have been restored from drainage?—No.

√29. *Q*. A good deal has been spent upon drainage as you are aware?—Yes.

√30. *Q*. A proposal is made to us of filling up the *nuddis* from the canals near the end of the rains and allowing them to be drawn upon for the rest of the season. Do you think that would be a proper measure?—It would depend upon the district; would not it? It would be impossible to speak generally of a thing of that sort. It would be almost impossible in Cawnpore; the *nuddis* are so low down. They do that sort of thing in Basti.

√(*Mr. Roberts.*)—In Basti and Gorakhpur they always bund the little streams after the rains. I don't think we have anything to teach them about that.

√31 *Q*. (*The President.*)—Are these at the foot of the hills?—No.

√32. *Q*. In the Tirhoot district these little rivers come down from Nepal, and just when they want them below, they are bunded up by the Nepalese?—There is considerable trouble in Basti and Gorakhpur with the Nepalese who complain that when these rivers are bunded below it floods their lands. The Nepalese have been fighting for, I should say, the last seven or eight years over these *bunds*. They have rather an elaborate system of private canals to the north of Basti and Gorakhpur.

33. *Q*. (*Mr. Muir-Mackenzie*).—Do these canals hold out in a year of drought?—Yes.

34. *Q*. (*Mr. Muir-Mackenzie*)—You were in charge of Cawnpore during the big famine?—No, I was in Etawah during that famine.

35. *Q*. Was the whole of Etawah affected?—Not the whole; only the southern portion and across the Jumna; that high ground here (indicates it in the map); that was very bad.

36. *Q*. Did you make *kachcha* wells by famine labour?—No; I made advances for them.

37. *Q*. Did you get rid of a large sum in Etawah in the way of advances in the famine year?—Not very large.

38. *Q*. How large?—I don't know the exact figures, but I should think we got through about ten thousand rupees; but I would not be at all sure about my figures.

39. *Q*. What do you get through in an ordinary year?—In an ordinary year we would not give any advances at all for *kachcha* wells.

40. *Q*. I mean advances altogether for wells and for land improvements?—You cannot compare the two unfortunately.

41. *Q.* Could you tell me how much did you get through in advances of all kinds in Etawah in the famine year?—No; I could not tell you.

42. *Q.* Not even very roughly. Did you get through a lakh of rupees?—Nothing like that.

43. *Q.* Half a lakh?—No. I should think it was about twenty thousand rupees.

44. *Q.* I don't suppose you had to take any very special measures to get rid of a sum no bigger than that?—All the Deputy Collectors went into camp and had money with them.

45. *Q.* Don't you think that might be done every year. —For *pakka* wells?

46. *Q.* For advances of every kind so as to prevent the intervention of the subordinate staff?—Your Deputy Collector has not time to do that.

47. *Q.* Then we come to the special officer?—Your special officer cannot be all over the district at the season for making advances. He would have no time to do it. Besides I don't like to specialise any work in that way. Something always goes wrong when a man is specially put on duty like that.

48. *Q.* What do you think would go wrong?—He would have so many favourites, and then his work would be supervised by nobody. You would have to appoint a most responsible officer to do that work.

49. *Q.* Could you not get a Deputy Collector to do it?—Yes; I have no doubt there are very many able Deputy Collectors capable of doing it, but I would far rather have my own Deputy Collector to do it.

50. *Q.* Do you think your own Deputy Collector has time?—No. He might do something in that way, but he would not have time to do it to any great extent.

51. *Q.* Would you not prefer the Deputy Collector should have the money in his pocket and make the enquiry on the spot and pay the money on the spot?—I see no objection whatever to that. I think it would be a good thing. As it is, he gets an order from the tahsil for the money, and he might as well have the money on the spot.

52. *Q.* I don't suppose you advocate the construction by Government of wells and taking a rate for them; do you?—That I should say would be a very good thing to do in certain tracts.

53. *Q.* Would not you be afraid the wells would be a great deal too expensive?

Witness.—Would you take a rate that would pay Government back for doing it?

Mr. Muir-Mackenzie.—Yes.

Witness.—Then I would not advocate it; I think it would pay Government in the long run; it would not repay Government at once in money.

54. *Q.* You would not take anything even like 40 per cent. of the cost?—I would not base it on the cost at all; I would take enhanced rental from them on the benefits done to their fields.

55. *Q.* You don't think that enhanced rental would come up to the cost?—No. I think Government would only need to do it in tracts where immediate advantage is not so apparent as in other tracts.

56. *Q.* Another objection is that if Government made the wells, there would be entailed a large amount of supervision to see them kept in repair. Do you think that would not be the case?—No.

57. *Q.* I suppose it would cost Government a great deal more to make a well of that sort than it would cost a cultivator or zamindar; would not it?—If it was to be made by the Public Works Department.

58. *Q.* If it was to be made by professional agency?—Yes.

59. *Q.* Is there any other alternative way to suggest their being made? Do you think selected tenants or zamindars should be given money to make wells themselves?—I doubt if that would be very feasible.

60. *Q.* What way would you adopt?—I can only suggest that the money be given to selected tenants or zamindars and that there be a minimum of professional supervision or interference.

61. *Q.* Do you think the famine has had an effect in educating people to take advances? Do you think they are any better disposed to take them than they were?—No. I don't think so.

(*Mr. Roberts.*)—Is not the whole cultivation by tenants done by advances, or how do they do it, with their own capital?

(*Witness.*)—You mean for seed and so on?

(*Mr. Roberts.*)—Yes.

(*Witness.*)—In lots of districts it is most certainly; in Cawnpore it is not.

62. *Q.* Take districts like Gorakhpur and Basti. The whole cultivation of tenants there is mainly done by advances; is it not?—Yes, to a great extent it is.

63. *Q.* Would it be too high to say that many lakhs of rupees are advanced to tenants for cultivation?

(*The President.*)—By Government do you mean?

(*Mr. Roberts.*)—No.

(*Witness.*)—In Basti and Gorakhpur there are lakhs undoubtedly.

64. *Q.* Then the Opium Department gives many lakhs; does not it?—Yes.

65. *Q.* And the indigo factories give some lakhs?—Yes.

66. *Q.* Would not the advances in all be about 10 to 20 lakhs at least?—Certainly, about ten lakhs.

67. *Q.* Is not it your experience that most of the wells are built by tenants or by zamindars?—They are mostly all tenants' wells. But you never find a tenant coming for an advance for a well.

68. *Q.* (*Mr. Muir-Mackenzie.*)—What is the reason for that if he builds so many wells? Is there any difficulty about security?—I don't think there would be any difficulty about surety; if he were a good tenant, his zamindar would go surety for him.

69. *Q.* Is not there an objection on the part of the zamindars to tenants making wells?—No. I don't think here is really.

70. *Q.* (*Mr. Rajaratna Mudaliar.*)—Zamindars grant advances to tenants to a very large extent you said. What rates of interest do they charge?—It depends. *Siwai* is the commonest thing. If the tenant is not a good tenant, they will take *adhai*. It depends on the relationship existing between the zamindar and his tenants.

71. *Q.* (*The President.*)—What is *siwai*?—One-fourth.

72. *Q.* (*Mr. Rajaratna Mudaliar.*)—Are Tahsildars and Deputy Collectors authorized to grant advances?—No, not without the sanction of the Collector; but if a Deputy Collector recommends that an advance should be given, most certainly it would be given.

73. *Q.* Do you see any objection to their being empowered to grant loans up to a certain limit? In Madras I might mention that Tahsildars are empowered to grant loans up to Rs. 250 and Deputy Collectors up to Rs. 500. That is with a view to save delay?—I see no objection to that.

74. *Q.* Will the tenants and landlords welcome it as a boon if the period of repayment were extended to, say, 15 or 20 years?—I don't know that they would welcome it as such a great boon. They might in some cases.

75. *Q.* At present not more than three years is allowed?—Generally about three years.

76. *Q.* Mr. Molony says the rules as to exemption from enhancement are not generally understood. Is that your experience?—They are understood so far that no zamindar does not know that he is not going to be assessed immediately.

77. *Q.* Are tenants sufficiently protected in cases where they carry out improvements at their own cost?—Yes, under the Act.

78. *Q.* Has there been any large increase in the number of wells during the last 15 or 20 years?—They are continually going on increasing, but it all depends. In some districts you might have a large increase; in others, very little.

79. *Q.* Has there been a large increase in Cawnpore?—In Cawnpore there has not been very much increase, because there has been an increase in the number of canals. For the last four years there has been an increase of 477 *pakka* wells in Cawnpore.

80. *Q.* In Cawnpore the area irrigated from wells in 1899-1900 was ninety-six thousand odd, and in 1900-01 it fell to sixty thousand and odd—a fall of more than 36,000 acres?—Yes.

81. *Q.* Was there any special reason for this heavy fall?—Not that I know of, but perhaps the rains were better that year.

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82. *Q.* Was it a very wet year?—I really forget now. The Christmas rains were very heavy that year. There is no special reason that I know of otherwise.

83. *Q.* Are these areas measured every year for the purpose of statistics?—They are not measured every year. The measures are taken once, and then the *patwari* puts down in his *khasra* which is irrigated area and which is unirrigated area in each field.

WITNESS No. 4.—THAKUR SITLA BAKSH SINGH, Manager, Manda Estate.

Thakur Sitla Baksh Singh.

21st Nov. 02.

(*To the President.*)—In the trans-Jumna part of Allahabad the northern part called Chaurasi Tappa is capable of being irrigated; the southern part has no irrigation, as it consists of black cotton soil which cannot be irrigated by tanks, wells or canals. Tanks are used for watering cattle and drinking. The tract lies between the Belan and Tons. There is no use, I think, in taking out a canal from the Tons or Belan. The proposed Belan Canal would not anything like repay the cost of making it, because of the prevalence of black cotton soil. The benefit to the country would be out of all proportion to the cost. The black cotton soil is sometimes 30 feet deep. Where it is 12 or 13 feet the sub-soil is rock, and where 30 feet deep it is sand. There are wells in the low lands of Manda and Chourasi, both *pakka* and *kachcha*. In the last 5 years the estate has made only three wells, of which two are for irrigation. The revenue of the estate is 1¼ lakhs. Where wells are possible there are plenty of them. In the southern part the people cannot have wells even for drinking. A *pakka* well would cost Rs. 1,200 or 1,500.

WITNESS No. 5.—MR. W. P. HOUSDEN, Executive Engineer, Kumaon Division.

Mr. W. P. Housden.

21st Nov. 02.

1. *Q.* (*The President.*) Have you had special experience in famine works?—I have had no experience. I was Personal Assistant to the Superintending Engineer.

2. *Q.* Have you had to do with the making of these schedules?—For the Allahabad Division only.

3. *Q.* Were you tied down to the office?—I was in the office the whole time.

4. *Q.* These figures passed through your hands for the Allahabad Division?—Yes.

5. *Q.* How were they prepared?—By District Engineers, as a rule, in consultation with the Executive Engineer and Collector; then they go to the Commissioner and to the Chief Engineer.

6. *Q.* Under whom is the District Engineer?—Under the Executive Engineer.

7. *Q.* Has each district an Engineer?—Not necessarily; there may be subordinate in charge.

8. *Q.* And who is the Executive Engineer?—The Divisional Engineer.

9. *Q.* The District Engineer is a member of the Public Works Department?—Yes.

10. *Q.* These statements were prepared by them and approved by the Collector?—Yes.

11. *Q.* Were they closely overhauled or practically accepted?—They were practically accepted, the reason being that a large number of people had to be provided for and it is difficult to provide for a large number.

12. *Q.* The bulk of these consists of village tanks in the Allahabad Division?—Yes. There are also works under the civil officers; the civil agency schemes would be prepared in the Collector's office without reference to the Public Works Department.

13. *Q.* What was under the Public Works Department?—Roads, drainage, digging of tanks.

(*Mr. Roberts.*)—Civil agency may be taken to mean village works.

14. *Q.* (*The President.*)—It is very difficult to find these works?—Extremely difficult; there are a number of works that could hardly be called works of public utility. The orders are that we must make provision for six months for 15 per cent. of the population, except in places which are canal protected; there it must be 5 per cent. The civil agency schemes must provide for a similar number.

15. *Q.* Is that throughout the whole of the United Provinces?—Yes.

16. *Q.* In places like Dehra Dun and Saharanpore?—Yes. In canal protected it is now 5 per cent.

17. *Q.* What is a canal protected district?—Where one-third of the cultivated area is protected by canals.

18. *Q.* This is made irrespective of the rainfall?—Quite.

19. *Q.* What is the meaning of the term used by Mr. Barlow "drought tract?"—It probably includes Bundelkhand and the southern parts of Allahabad.

20. *Q.* How is that laid down?—I don't know. I think it is an expression that has grown up without any special order.

21. *Q.* You were with Mr. Palmer when works were in progress?—Yes.

22. *Q.* I suppose it was difficult to find works under the high pressure of time?—There was no difficulty in finding works; works were found just as they were required. The difficulty was to find useful works.

23. *Q.* Since then have these lists been kept up to date?—Lists have been amplified in all the districts to work up to this percentage fixed by Government.

24. *Q.* This percentage was not originally fixed?—No; it was fixed after the famine in December 1900.

25. *Q.* What was the work most appreciated by the famine authorities; Revenue and Public Works officers?—Digging of tanks in some cases and making *bunds* in others; the work done was chiefly raising roads.

26. *Q.* What sort of *bunds* were made?—In Bundelkhand they were simply embankments thrown across the valleys.

27. *Q.* Was work done at public expense merely benefiting private individuals?—Not in all cases. Roads for example and some tanks.

28. *Q.* In any case would it be considered a bar to the carrying out of a work; the fact that only one or two people would benefit?—No; it was not looked upon as a bar. Some tanks could not be useful to anybody but the people; Government would not benefit.

29. *Q.* As regards *bunds* that hold up water in little valleys and which would benefit merely a few people, were these done by famine work?—The *bunds* we put up were high ones.

(*Mr. Roberts.*)—One exception was the Chakkia.

(*Witness*)—My experience is confined to Allahabad.

(*Mr. Roberts.*)—Of course in this way you get a better tale of work done.

30. *Q.* (*Sir Thomas Higham.*)—You have been connected with these programmes?—Only for the Allahabad Division.

31. *Q.* In the Allahabad Division the great mass of relief works are small village works?—Yes.

32. *Q.* You would have liked more, but you could not find them, I suppose?—I think it works up to 15 per cent. of the population.

33. *Q.* What is classification "miscellaneous" that occurs here?—I don't know it. I have not seen this statement before this.

34. *Q.* Supposing you had a big tank in a village which employed over 5,000 men, would that be called a village work?—Yes, unless it appeared in the Public Works Department programme. Two programmes have been made up. The work would be put into the village works programme if it did not appear in the other.

35. *Q.* But any works employing over 5,000 would naturally be put into the Public Works programme?—I think they would if they employed 5,000 for any length of time.

36. *Q.* The question is whether we may take these village works as representing small works that would only employ a few people?—I cannot say. I have not seen the civil agency programmes for village works.

37. *Q.* What are they?

(*Mr. Roberts.*)—They are nearly all deepening or enlarging existing tanks.

38. *Q.* (*Sir Thomas Higham.*)—Is there any programme of village works?—I suppose they have programmes in the Collector's office.

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39. *Q.* Are they made out by the Collector?—Yes.

40. *Q.* Are they made for each tahsil?—Yes.

41. *Q.* Who takes the initiative?—The Tahsildar, I think; in the winter the Collector goes round and sees if they are good enough to be put into the programme.

42. *Q.* (*Mr. Muir-Mackenzie.*)—Have you got maps showing where the different works are situated?—They are being prepared in the Secretariat.

43. *Q.* Will they include village works?—Not the maps; we sent in for departmental works.

44. *Q.* Was there any work done in the last famine that you don't consider to have been of much utility?—A great deal in places.

45. *Q.* Particularly what?—Roads in some cases; they were not continuous; only bits were made and it has not been found possible to complete them. They would be useful if they were completed.

46. *Q.* (*Mr. Roberts.*)—Was there not the difficulty that the height of the roads was not always determined by engineering considerations, but by considerations of the amount of labour to be provided for?—As a rule, an average height of 2 feet was adopted irrespective of actual requirements.

47. *Q.* (*Mr. Muir-Mackenzie.*)—You say in some case the work was not useful?—Yes. Metal was collected and we have not been able to make use of it.

48 *Q.* Why was no use made of it?—Because it was collected in a part of the district where there were only *kachcha* roads and the District Board could not make them *pakka*; they had not the money to do it and to maintain them afterwards.

49. *Q.* Can you suggest anything else that might have been provided, and that would have been more useful?—I cannot in the Buildings and Roads Branch; we can only raise roads, dig tanks and make *bunds*.

50. *Q.* What sort of *bunds* do you think practicable only large *bunds* or a series of small ones?—It depends on the lie of the country; if it is flat sloping country, a long *bund* would be best; in country where there are valleys big *bunds* thrown across the valleys would be best.

51. *Q.* How small a *bund* could be efficiently managed? Could you manage a series of quite small *bunds*?—In the south of the Allahabad district you could.

52. *Q.* There are parts of the country where they would be useful?—Yes.

53. *Q.* Have any of the tanks dug been used for irrigation?—They were not meant for irrigation; they were simply village tanks deepened. Some would be useful for irrigation.

54. *Q.* (*Mr. Rajaratna Mudaliar*).—(Handing to witness abstract of latest famine proceedings for districts of the United Provinces), I suppose the figures in column 13 represent so many units in thousands?—Yes.

55. *Q.* Dividing that figure by the estimated cost in the last column you get for one rupee 37½ units for six months; do you think the figure is correct?—It is for one day. It should work to 40. I have not seen this statement before.

56. *Q.* (*The President.*)—One rupee keeps 40 units alive for one day?—Yes. One rupee of work estimated at normal rates.

57. *Q.* (*Mr. Rajaratna Mudaliar.*)—In the programme very little provision is, I see, made for metalling?—I think in Allahabad, Cawnpore, and Fatehpore there is a fair amount; I don't know the other districts.

58. *Q.* (*Mr. Muir-Mackenzie.*)—Is there any class of useful work that you can suggest to put in the programme?—In Lucknow, for instance, you might employ men in levelling ravines and making building sites if there was no objection to their working in the station.

59. *Q.* I don't suppose the 30 per cent. standard is ever reached; is it?—I don't know. To my mind it seems far too much for all districts.

60. *Q.* (*Mr. Roberts.*)—Allahabad was a bad district?—Yes, and Bandi was very bad.

61. *Q.* Did it reach this figure?—At the worst time the numbers on works went up to 250,000; that was for a short time.

62. *Q.* Supposing you had to provide for only 10 per cent., do you think you could get useful works done in six months?—Not useful works; that is to say, works that you could always maintain.

63. *Q.* (*The President.*)—Especially if you lay down the rule that you are not to go very far?—There is no difficulty in finding works; the difficulty is to find such as are useful afterwards.

64. *Q.* (*Mr. Muir-Mackenzie*).—Could not you get larger proportion of useful works, if you had time for consideration?—I think so; the programmes were made in a hurry and the idea was to prune them later on. As far as the canal districts go and the orders about 5 per cent. are now in force, there will be useful works done, but where the orders lay down that there should be 15 per cent. departmental and 15 per cent. civil works; I don't think we could find useful works even if there was time to work them out.

65. *Q.* Could you find work for 5 per cent.?—I think so.

66. *Q.* (*Mr. Roberts.*)—One difficulty is that these works are primarily for famine relief and any work to be useful requires a lot of expert labour?—Yes, that means a lot of money to be spent later on to keep the work in proper order.

FIFTEENTH DAY.

Allahabad, 22nd November 1902.

WITNESS NO. 6.—MR. E. A. MOLONY, Collector of Ghazipore.

(*Replies to printed questions.*)

Mr. E. A. Molony.

22nd Nov. 02.

A.—GENERAL.

Question 1.—My answers refer to the Aligarh district. I was Collector of Aligarh for three years from March 1897 to March 1900.

Question 2.—I have no records to refer to and cannot say.

Question 3.—There are no obstacles to the extension of irrigation from—

(1) sparsity of population;

(2) fewness of suitable cattle

(3) insufficiency of manure;

(4) unsuitability of soil.

(5) The Canal Officers can say whether the Ganges Canal has sufficient water for the extension of irrigation. I fancy it has if water is economized.

(6) I do not think lack of private capital prevents the extension of irrigation for three reasons—

(*a*) there is no scope for private canals in the district;

(*b*) as to tanks, the digging of the tanks is too expensive to be financially remunerative;

(*c*) as to wells, I do not think that want of capital is the reason for their non-construction. Zaminadars who do not go in for well-sinking manage to find money for

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their extravagances or for buying villages, so it is clear that want of capital is not the chief reason for failure to build wells, though it may deter a few.

As to the lack of funds for the more expensive cultivation of irrigated crops, I have never heard it even hinted at as the reason why wells are not built.

(7) The fear of enhanced revenue assessment is undoubtedly one of the causes which prevents wells being made. The people do not know the orders, of Government about the non-liability to assessment of revenue of the increased rental gained by irrigation improvements. When I was Assistant Settlement Officer at Lucknow no one ever pointed out new wells until I began to make enquiries, and the people learnt by experience that I would assess lightly on land irrigated by new wells. Then they began to come forward, which shows clearly that they had not expected such treatment. Even now I believe the intentions of Government are not widely known. The Committee might enquire how many applications have been made under Board's Circular I-B. I fancy they will be found ridiculously few.

The fear of enhanced rent does not deter tenants from making wells. A non-occupancy tenant has not the right to make masonry wells, and an occupancy tenant would be able to plead successfully the construction of a well in a suit for enhancement.

(8) Uncertainty of tenure and defects of tenancy law have in the past prevented well sinking by tenants. Even a fairly enlightened zamindar like the Raja of Mursan would not allow his occupancy tenants to make *pakka* wells, though his action was illegal. The new Tenancy Act will do much good in this respect. I had numerous applications by occupancy tenants for permission to sink wells, which shows that they did not know their rights. In my answer to Question 25 I make some remarks on amendments in the law.

(9) *Other reasons.*—There are certain tracts in which well-sinking and tank construction is well nigh impossible owing to the natural conditions or in which the initial cost is too great for the expenditure to be financially remunerative.

Question 4.—Land irrigated from works constructed by private capital is exempt from enhancement of assessment during the currency of the settlement next following the one in which the improvement was made.

In practice the exemption is secured by the Settlement Officer making an *estimate of the reduction* on the assets which he is prepared to allow on account of the improvement. Every Settlement Officer has his own method. I think I allowed about Rs. 50 for each good well. It depended on the well and the amount was settled by guesswork and not by calculation. I was not on settlement work when the distribution of *jama* was made, but I suppose the reductions went to the parties entitled to them.

Tenants can claim exemption from enhancement on account of the increased value of the produce of the land gained by irrigation improvements made by them. The existing provision seems to me sufficiently liberal. Assistant Collectors in general are glad to get hold of such an easy means of disposing of cases that are particularly troublesome. The existing provisions are sufficiently liberal. I have seen it advocated that Government should permanently exempt from enhancement of revenue land irrigated by means of masonry wells. If and when the present system of exempting for one whole settlement, together with the unexpired portion of the settlement current when the work was constructed, has failed after a fair trial, I would recommend permanent exemption, but the present system so far has had only the beginning of a trial.

Question 5.—Loans under the Land Improvement Act are not freely taken. The reasons are threefold—

(*a*) Overwork.

(*b*) Responsibility.

(*c*) Rapacity of subordinate officials.

(*a*) *Overwork.*—Tahsildars and Collectors have too much work as it is to get through it in a really satisfactory manner. Government will not accept the plea of overwork even in trifles. A District Officer has, therefore, to bear in mind that if he shows much activity in this line, he will almost certainly have to furnish explanations in some other department. This applies with greater force to Tahsildars, who have the very greatest difficulty in collecting *takavi.*

(*b*) *Responsibility.*—If *takavi* becomes irrecoverable, a Tahsildar thinks that it will be put down to his slackness, and he naturally is in no hurry to put himself in such a position. The amount of *takavi* that actually becomes irrecoverable is so small (except in the case of famine *takavi*) as to lead one to suppose that *takavi* is only given to people who have exceptionally good security and who could raise money in the ordinary way.

If Government wish to extend *takavi* advances largely, I think that it must be prepared to accept a larger proportion of bad debts, and I think Collectors might be given authority to write off as irrecoverable a certain proportion, say 5 per cent., of the demand maturing in each year without having to furnish explanations.

(*c*) *Corruption.*—I have no doubt that the kanungo or other subordinate official who makes the local investigation and the tahsili accountants do in many cases take toll on the money advanced and recovered, but I do not think the amount is very large, nor can it be stopped till the standard of honesty of the *amla* is much raised.

(*a*) I would not recommend a reduction in the rate of interest, because the interest now charged is much lower than the market rate and the necessity for paying it is not the reason for more *takavi* not having been taken.

(*b*) For the same reason I would not recommend a remission of the interest.

(*c*) In the matter of partial remission of the advances I think this might be tried in tracts where owing to the cost of the works being very great their construction would otherwise be unremunerative, but I would certainly not advocate it generally as it would tend to pauperize the people.

(*d*) Total remission in case of failure to obtain water would lead to great abuses and is to be deprecated except in very exceptional cases. In most tracts the practicability or impracticability of wells is well known, and in all cases of doubt a trial boring should be made by the tube well which will definitely settle the matter.

(*e*) The period of repayment might perhaps be extended in the case of works which are very costly except where partial *remissions* are given.

(*f*) Grants-in-aid are precisely on the same footing as partial remissions.

My suggestions for the encouragement of loans under the Land Improvement Act are as follows:—

It is first necessary that for each tract in which objections are contemplated a survey of the relative position of the clay strata (*mota* or *tawa*) and of the water level be made as recommended by me in paragraph 20 of Agricultural Bulletin No. 12. This should be done by an official specially trained for the purpose. By this means a record will be obtained of the depth to which wells will have to be sunk in each village and the difficulties likely to be encountered.

Wherever there is a reasonable doubt about the depth at which the clay will be found trial borings should be made with the tube well apparatus of the Director of Land Records. It will then be a simple matter to estimate the cost of a well in any particular locality.

The official deputed for the purpose will then be in a position to say that in such and such a village wells are required in such and such positions which are likely to cost such and such sums. A permanent record should then be made of the wells considered desirable with their estimated cost. This completes the work of the special officer. A copy of the list should be furnished to the lambardar of each village with an intimation that Government will always be ready to sanction *takavi* for such wells up to the amount entered for each, provided that proper security is furnished.

The zamindars or tenants could, when they wished to build such a well, apply to the Collector for the advance.

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No local inspection would be necessary and it would only be necessary to verify the security.

At present the officer making a local inspection probably cannot in many cases ascertain what a well will really cost; he may badly under or overestimate the cost, and in either case there is a waste of money that might be more usefully employed.

Under the new Tenancy Act it is probable that the tenants will do most of the improvements, and it is very desirable that occupancy tenants should be allowed to give their holdings as security for their advances. For this purpose legislation will be required and I would propose the following:—

Act to authorize certain tenants to use their holdings as security for takavi advances.

I.—When any tenant with a right of occupancy, but without a saleable interest, wishes to give his holding with the improvement proposed to be executed on it as security for a loan under the Land Improvement Act, he may apply to the Collector or Assistant Collector.

II.—The Collector or Assistant Collector shall issue a notice on the landholder.

III.—The landholder may object (1) on the ground that he is prepared to execute himself the same or an equally useful improvement for the benefit of his tenant; (2) that the proposed improvement is useless or unsuitable for the holding or inconsistent with the purpose for which the land was let.

IV.—If the objection is on the second ground, the Court shall decide whether the proposed improvement is proper, and, if it is, shall allow the tenant to give the holding as security.

V.—If the objection is on the first ground the Court shall, if it thinks that the landholder's offer to make the improvement is genuine, give him a reasonable time in which to make the improvement, and if it thinks that the offer is not genuine, the Court shall pass an order authorizing the tenant to pledge his holding as security for the advance.

VI.—If the landholder fails to make the improvement within the time allowed or any further time that the Court may allow, the Court shall pass an order authorizing the tenant to pledge his holding as security for the advance, and may give reasonable damages to the tenant from the landholder.

VII.—If the landholder raises no objection to the tenant's application, the Court shall pass an order authorizing the tenant to pledge his holding as security for the advance.

VIII.—When a tenant has taken an advance under the Land Improvement Act after having obtained an order under section IV, V, VI or VII, and has given his holding as security for the repayment of the loan, if he makes default in repayment of any instalment, or if he is ejected under the Rent Act, or if he dies without heirs or disappears, it shall be lawful for the Collector to sell his holding, and the purchaser shall have the same title and rights as the tenant whose holding has been sold.

Question 6.—The extension of irrigation does not tend to injure the remaining cultivation by drawing away its cultivators.

B.—CANALS OF CONTINUOUS FLOW.

Questions 7, 8, 9, *and* 10.—I do not feel qualified to answer these questions.

✓ *Question* 11.—The result of draining land where there is a salt efflorescence is to remove the efflorescence. I noticed a very marked case of this. When I was in camp at Khair in 1886 or 1887 the land to the north-west of the camping ground was covered with at least two inches of *reh* as white as snow. Shortly afterwards the Karon Naddi drainage was carried out, and when I returned to the district in 1897 the *reh* had quite disappeared and the land seemed to me as if it had become culturable.

C.—CANALS OF INTERMITTENT FLOW.

Questions 13 *to* 22.—There are no canals of intermittent flow in the district of Aligarh.

D.—TANKS.

Questions 23 *to* 33.—There are practically no artificial tanks in the district, but the natural *jhils* are much used for irrigation. They get filled up in the rains; no one ever looks after them or dredges them; no one charges water rate for the use of the water, but the zamindar of course gets higher rent for fields which can be irrigated. Some *jhils* never dry up even in dry years; in others the water is always used up except in years of excessive rain. Large *jhils* irrigate a large area and small ones a few fields only. When the water in a *jhil* lasts for the final watering well irrigation is unnecessary. The water is lifted out of the *jhils* by leather buckets of the shape of large dust pans with four cords worked by two men, one on each side. The only expense is the labour of lifting which falls on the cultivator.

The construction of artifical tanks is not required as the extension of irrigation can be better secured by the construction of wells.

E.—WELLS.

Question 34.—(1) It is most important to dismiss at once the idea that a well is simply a hole sunk in the ground till water is reached, and that in some places there is water and in some no water. There is water everywhere, but in some places it is not attainable in sufficient quantities for irrigation. The question to ask is not is there water, but is there a *mota* or *tawa*, or by whatever other name the all important combination of clay or *kankar* and sand is locally known. This stratum of clay or *kankar* overlying water bearing sand is necessary to form a roof to the collecting cavity in the sand which is essential if a large discharge of water is required, as otherwise sand is drawn into the well and the foundation is undermined. The subject is treated of in Agricultural Bulletin No. 12 and it cannot be profitably condensed further. Every spring well must be taken down to the *mota*, and consequently the depth of the water level from the surface is not necessarily any criterion of the depth of the well. As has been shown in the bulletin, a rise or fall of five feet may make a difference of 20 or 30 feet in the depth of the well; therefore it is very difficult to say what is the average depth of permanent wells. The depth of the percolation level from the surface varies from about 10 feet near the main Ganges Canal to about 55 feet in parts of pargana Mursan and the wells must of course be still deeper. There are a few *pakka* wells in pargana Mursan, the cylinders of which are 75 feet long.

(2) It is of great importance to bear in mind that percolation wells are practically non-existent in the district. A percolation well would with difficulty irrigate an acre of crop each season.

Pakka wells are not liable to fail in years of drought, as no one makes a *pakka* well unless he knows that the *mota* is sufficiently submerged to give sufficient allowance for a fall in the water level in a year of drought. If this is not the case, it is quite effective and much more economical and easy to make a *kachcha* well. In the south-west part of the district many *pakka* wells have become permanently useless owing to a gradual change in the water level. I reported the matter, and the Mat Branch of the Ganges Canal is, I believe, to be carried out to set matters right.

Saline wells.—There are certain wells in the district which are always salt, but which get salter in a year of drought. The amount of salinity varies from a hardly noticeable brackishness to such a degree of salinity that neither man nor beast can touch it. Whenever the salinity of the water is considerable it is useless for germination purposes; seed sown on ground irrigated with it will not germinate; but after the seed has once germinated the salt water is very good for the crop.

(3) The average cost of construction of *pakka* wells varies from Rs. 50 to about Rs. 1,000 or Rs. 1,200 according to locality. The average cost of *kachcha* wells varies from about Rs. 4 to Rs. 50. The difference in the case of *kachcha* wells is chiefly due to the cost of the wooden lining (*garoli*) that has to be sunk when wet sand overlies the *mota*; the actual cost of digging is nearly always inconsiderable.

(4) The average duration of *kachcha* wells varies very much; sometimes a well falls in before it is even finished or only lasts a few weeks. In other cases a well lasts a lifetime. I have seen *kachcha* wells working said to have been 40 or 50 years old. Where the earth is firm *kachcha* wells will last for a long time.

(5) Water is raised by a leathern bucket worked by two pairs of bullocks on the *kili* system.

(6) and (7) I can't say without statistics.

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Questions 35, 36, *and* 37.—I cannot answer these questions.

Question 38.—(1) As explained in the reply to paragraph 34, there is water everywhere sufficient for domestic purposes, but its availability for the purposes of irrigation depends on the presence of a *mota*. I have given some proposals in the answer to question 5. The chief thing that the people require is that Government should have a survey of the *mota* made, and that in cases of doubt its existence should be verified by means of trial borings.

(2) Difficulties are encountered in the actual construction of wells, but native professional well-sinkers understand practical well-sinking far better than most British engineers and need no help except in the provision of efficient sand dredgers. I would suggest that a Bull's patent dredger should be put in each tahsil for hire at the rate of Re. 1 per mensem. These dredgers are much more efficient than the native *jham*.

The tube well apparatus of the Director of Land Records can be lent to any one who applies for it. I have utilized it with great advantage in Court of Wards' villages, and Ahmad Said Khan of Nah in the Atrauli tahsíl also applied for the services of the tube well-sinkers, but I don't know whether he ever actually utilized them.

Question 39.—I am not in favour of the construction by Government of wells in private property. This has been tried once before—*vide* the papers relating to the construction of "wells" published a good many years ago by the Department of Land Records and Agriculture, and ended in failure.

In the first place, most engineers do not understand the conditions necessary for success. The wells sunk by the Public Works Department are generally for drinking purposes only and present no difficulties. Irrigation wells are on quite a different footing.

In the second place, the Public Works Department rates are extremely high, and, if the salary of the supervising staff is charged to the work, I am almost certain that the work will cost two or three times as much as the zamindars would pay for the same kind of work.

In the third place, if Government pays the cost and charges a water rate, endless dissatisfaction will be caused, because—

(1) the rate will be much heavier than would have been necessary had the zamindar done the work;

(2) the collection of the rate would mean constant meddling by the subordinate staff and the necessity for bribing;

(3) it would in some cases be very difficult to say whether a field was irrigated from a zamindar's or a Government well;

(4) the cost of repairs of thousands of wells scattered all over the country would be very great and the supervision necessarily most perfunctory.

Question 40.—A very large part of the well irrigation is from *kachcha* wells. Some *kachcha* wells are anything but temporary, but others of course last only a very short time.

The next question—"how far are they a protection against drought"—is very ambiguous. If it means "in years of drought, can a tract ordinarily without irrigation be irrigated by means of *kachcha* wells:" the answer is only in a very few and rare cases. If it means "in a tract ordinarily irrigated by *kachcha* wells, does the water fail in a year of drought:" the answer is only in a few rare cases. The fact is that the failure of one monsoon makes very little difference in the sub-soil water level. Out of an average of 30 inches of rain, supposing that 2 inches are evaporated, that 13 inches flows off, and that 1 inch is formed into hydrocarbons. Then only 14 inches soaks into the sub-soil. If you put 14 inches of water into a long glass cylinder and then pour in sand till the top of the sand and water coincide, you will get the depth of dry sand that will absorb 14 inches of water. It will probably not exceed 3 feet. It follows that a total failure of the rains in one year will only lower the sub-soil water level about 3 feet (making no allowance for the supplies required for wells).

This amount of fall in the water level will only affect a very small proportion of the *kachcha* wells, *i.e.*, wells in those localities where the conditions are such that (*a*) wells can only just be made, or (*b*) wells can just not be made. For instance, take a tract in which the *mota* is only submerged 9 feet, a reduction of 3 feet would very seriously affect the discharge of *kachcha* wells in such a tract. Again, take a locality in which the *mota* is covered by 16 feet of saturated sand: in such a locality *kachcha* wells would be practically impossible, but if the depth of saturated sand was reduced to 13 feet, it is probable that wells might be successfully sunk.

It may, in fact, be enunciated that any change in the water level, whether a rise or a fall, will make *kachcha* wells possible in certain localities where they were not possible before and will make them impossible in certain localities where they were before possible.

With reference to the question how I would propose to encourage their construction in a year of scanty rainfall, the answer is that in such seasons the cultivators know that it is as necessary to dig wells as to plough and sow the land: they also know how to do it.

The only question for decision is—have they the means both to dig and to plough and to sow. If not, they should get *takavi*. If what I have before suggested is carried out most of the data will be known. The cost of a well in each village will be known; the cost of seed per *bigha* and the area of each tenant's holding will also be known, and the only thing that will not be known is how much of the total estimated expenditure each tenant can provide and how much should be lent him. This will have to be guessed by the distributing officer.

Question 41.—I have now answered all the questions put down, but I would crave permission to make a few remarks on the proper relations between well and canal irrigation.

Canal water is precious and requires to be economized, as there are many tracts that require it very badly and for which water is not at present available.

In my answer to question 40 I have stated that any change in the water level will make *kachcha* wells possible in certain localities where they were not possible before and will make them impossible in certain localities where they were before possible.

Government and its officers have heard a great deal about the introduction of canals having caused *kachcha* wells over large tracts to collapse, but they have not heard anything about the areas where the introduction of canal irrigation has made possible the construction of *kachcha* wells, for the very good reason that the people won't use well irrigation or even admit that *kachcha* wells are possible when canal irrigation is so cheap.

My suggestion is that a complete survey of the *mota* should be made all over the Ganges-Jumna Doab and the tracts classified somehow as follows:—

(*a*) Canal irrigated villages in which *kachcha* wells are impossible, and in which they would remain impossible with any possible reductions of the sub-soil water level.

(*b*) * Canal irrigated villages in which *kachcha* wells are impossible, but in which they would be rendered possible by a practicable reduction of the sub-soil water level.

*See note to (*c*).

(*c*) Canal irrigated villages in which *kachcha* wells are possible, and in which they would remain possible after the reduction of the sub-soil water level caused by a withdrawal of canal irrigation.†

(*d*) Canal irrigated villages in which *kachcha* wells are possible, but in which they would not remain possible after the reduction of the sub-soil level caused by withdrawal of canal irrigation.

(*e*) Other villages in which *kachcha* wells are impossible, and in which they would remain impossible with any practicable raising of the sub-soil water level.

(*f*) Other villages in which *kachcha* wells are impossible, but in which they would be made possible by a practicable raising of the sub-soil water level.

(*g*) Other villages in which *kachcha* wells are possible, and in which they would remain possible after the rise in the sub-soil water level caused by canal irrigation.

(*h*) Other villages in which *kachcha* wells are possible, but in which they would not remain possible after the rise in the sub-soil water level caused by canal irrigation.

It is clear that canal irrigation must be maintained in villages in classes (*a*) and (*d*), but that it might be wise to withdraw it from villages in classes (*b*) and (*c*).

It is also clear that canal irrigation is indicated in villages in class (*e*) and perhaps partial canal irrigation in villages in class (*f*), and that canal irrigation is not required in villages in classes (*g*) and (*h*).

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† NOTE—Classes (*b*) and (*d*) would probably be very small.

A careful consideration of the whole case would show the probable result of withdrawing canal irrigation from classes (*b*) and (*c*) and giving it to classes (*e*) and (*f*). It might be that the changes likely to be caused in the sub-soil water level would be found to affect villages in class (*h*) so severely as to necessitate the extension of canal irrigation to them also or the abandonment of the scheme, but it is probable that the result of such a working plan would be to economise canal water where it is not essential and make it available for villages that want it very badly.

In any case Government would be able to make a forecast of the probable effect of new distributaries and drainage cuts, and to see where spare water should be used to fill tanks and where it should not; where more water is required and where less.

Of course the owners should have to be compensated for the withdrawal of canal irrigation and this should be done on a liberal scale. The necessity of granting compensation would be a guarantee that the withdrawal was only made for good and sufficient reasons.

Question 42.—I believe that it would be possible in certain localities to raise the sub-soil water level to a perceptible extent without any very great expenditure.

Examples are given in Colonel Clibborn's report on irrigation printed in the "Papers relating to the construction of wells" referred to in my answer to question 39 showing the extraordinary effect on the sub-soil water level of a local source of supply.

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What I would propose for a tract like pargana Mursan, most of which has suffered from a very heavy fall in the sub-soil water level, would be to make the Karon Naddi, the local course of supply, more efficient. This would be effected in two ways: the first by building a series of low dams to hold up the water at the end of the rains; and, secondly, by sinking some *kachcha* wells in the bed of the stream till they reached the water bearing sand stratum. These wells would then be filled with coarse sand or fine gravel. At the top they would be widened out, so that even if a deposit of silt formed over the sand, the area would be sufficient to give a good supply of water to the well.

It is a well known fact (*vide* Encyclopædia) that an artesian well can be made to absorb the same amount of water as it gives out if the discharge pipe is carried up to double the height above ground level to which the water will naturally rise; and if a head of 8 feet in a well will give a very large discharge (as it undoubtedly does) there is no reason to doubt that a head of 40 feet or more as there would be in such a well would give a very large supply to the sub-soil. This supply would be continuous as long as there was any water in the river, and a series of such wells would undoubtedly to some extent counteract the fall in the sub-soil water level.

Wherever there is a canal flowing through a tract in which it is advisable to raise the sub-soil water level the surplus water should be utilized to fill tanks instead of being sent down escapes.

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1. *Q.* (*The President.*)—You are now Collector of Ghazipore?—Yes.

2. *Q.* Until March 1900 you were Collector of Aligarh for three years?—Yes.

3. *Q.* Have you been at Ghazipore since then?—I have been for two years at Ghazipore.

4. *Q.* Then you have experience of both districts?—Yes.

5. *Q.* You say in reply to question 7 "the fear of enhanced revenue assessment is undoubtedly one of the causes which prevents wells being made. The people do not know the orders of Government about the non-liability to assessment of revenue of the increased rental gained by irrigation improvements." It is rather sad that I suppose it has gone all through the country and that the *patwaris* have been informed?—I don't know to what extent the Board's circulars have permeated down to the agricultural classes.

6. *Q.* Are these orders recent?—As far as I know they are probably seven years' old. My reason for saying that was that I was Assistant Settlement Officer at Lucknow for about two years and I wanted to bring down the enhancement of revenue as far as possible: in fact, these were our instructions, and I thought that one of the best methods of doing that would be to allow a reduction for new masonry wells, and at first I found great difficulty in ascertaining what the new masonry wells were, because people did not seem to like to say which were the new wells. I believe they thought I was searching for them to enhance on them, whereas after a time when they began to understand they were getting a reduction, then they came forward a bit more.

7. *Q.* But that was how long ago?—About six or seven years ago, I should think.

8. *Q.* Mr. Roberts says the orders were out long before that?—They may have been.

(*The President.*)—It surprises me that they should not get to know a thing which fundamentally concerns their own interests.

9. *Q.* (*Sir Thomas Higham.*)—Your staff would know where the new wells were?—I could find out where they were.

10. *Q.* They could not conceal that?—No.

11. *Q.* (*The President.*)—You go on to say—"The fear of enhanced rent does not deter tenants from making wells. A non-occupancy tenant has not the right to make wells, and an occupancy tenant would be able to plead successfully the construction of a well in a suit for enhancement." As a matter of fact, do the occupancy tenants make wells?—I think a very considerable number of wells are made by tenants.

12. *Q.* Ghazipore is a permanently settled district; is not it?—Yes.

13. *Q.* What is the arrangement there as regards enhancement for wells?—There are a certain number of fixed rate tenants whose rent cannot be altered or enhanced under any circumstances: the status of the other tenants is the same as in other parts of the United Provinces.

14. *Q.* Therefore after a certain number of years there would be enhancement?—It would depend whether the landlord applied to enhance or not.

15. *Q.* As regards the landlord, what does he pay, suppose he made any improvements?—He would not have to pay any extra revenue to Government.

16. *Q.* Nothing?—Nothing.

17. *Q.* You say at the bottom of page 32—"I would not recommend permanent exemption, but the present system so far has had only the beginning of a trial." Was it not in the settlement of 30 years ago?—I have no personal experience to judge, but from the assessment statements I have seen in Lucknow, which I was re-assessing, I never came across a case in which they seemed to have made allowance for improvements of that sort.

(*Mr. Roberts.*)—The settlement now expiring was made 30 years ago. There was then no way of bringing the benefit of improvements—wells, which were mostly tenants' wells—down to the tenant, because the landlord took the rent and the assessment was based on the landlord's rent, modified in the old settlement by the Settlement Officer's estimate of what the rent ought to be.

(*The President.*)—There was never any idea of diminishing the estimates on condition the landlord made a corresponding diminution in his rent?

(*Mr. Roberts.*)—No.

18. *Q.* (*The President.*)—You say in reply to question 5—"Loans under the Land Improvement Act are not freely taken," and you give three reasons for this, *viz.*, (*a*) over-work, (*b*) responsibility and (*c*) rapacity of subordinate officials. It is very much the same evidence as we have had all over the country. You go on to say—"Tahsildars and Collectors have too much work, as it is, to get through it in a really satisfactory manner." Are you, to begin with, in favour of pushing on *takavi* advances and giving them freely for land improvements, say, for wells?—It seems to me that in an ordinary season you don't get much in the way of applications for *takavi*, but it is when the crops are very bad and the people have a difficulty in paying their revenue that you get a great rush of applications for *takavi*, which always gives rise to the idea that the desire to get *takavi* is not so much the desire to improve as to get a little ready cash. And then again when you give out *takavi* you really do not know what a well will cost and you have to rely on the *kanungo* or Tahsildar's report that a well is really needed, and all these things take up so much time and there is such delay and leakage that I don't know at present that you really would do very much good by giving *takavi*.

19. *Q.* Would you advocate a special officer being told off to go about with money in his pocket, and to take up these

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cases and settle them in a more summary way? Do you think that would be an improvement?—I think, if you have one officer to give *takavi* and the other to collect it, you will find that a very fair amount of *takavi* will be realised with great difficulty, because the Tahsildar reports for *takavi* given through the Tahsildar, and he is the best man to know with what difficulty Government dues are likely to be collected.

20. *Q.* As a matter of fact, do the Government lose very much in bad debts from *takavi*?—I think they lose very little, except possibly with famine *takavi*, of which I have had no experience.

21. *Q.* Do you think, if difficulties would be got past, that it would be for the good of the country to borrow more from the Government for improvements like wells?—Yes, I certainly think it would be a good thing; only you want a more or less settled plan of operations, and you also want to know where wells are required and how much they are likely to cost, so that when a man applies for *takavi* you could look up his village and say "a well here will cost so much and there is a real necessity for wells here." Then you would save one preliminary enquiry any way. You would say to the applicant "a well in your village is likely to cost Rs. 250, and if you can furnish the necessary security, I will lend you Rs. 250." And then you would save time too.

22. *Q.* (*Sir Thomas Higham.*)—Is there any limit for the amount given for a well?—For any particular well there is no limit. You are bound by the amount allotted to you.

23. *Q.* (*The President.*)—Do you generally spend as much as you get allotted to you?—It depends chiefly on the season. If it is a bad season, you could generally spend much more than is allotted to you, while in a good season you may find difficulty in spending what you have got.

24. *Q.* In how many years do you generally require the advances to be repaid for *pakka* wells?—In Ghazipore six or seven years generally.

25. *Q.* Do you remember what it was in Aligarh? About the same generally?—I cannot remember.

26. *Q.* Elsewhere in the south of India they grant 20 years, and the law allows you to go as far as 30 years. Do you think the people would take advances more readily if there was a longer time given to them in which to repay?—I should think they probably would, but your security in the meantime might have been deteriorating.

27. *Q.* Yes, Government has got to risk a little?—And again in some pplces wells cost a great deal of money, and of course the more you could spread it out, the more likely people are to borrow.

28. *Q.* Do you think then that a little more elasticity in that respect might be helpful?—Yes, I think it very likely would.

29. *Q.* You say at the bottom of page 31—"Total remission in case of failure to obtain water would lead to great abuses and is to be deprecated except in very exceptional cases." What are the great abuses you contemplate?—It is exceedingly difficult to say whether you will get water or not. If they knew there was a chance of getting it remitted they might borrow a large sum for building wells with the full intention of spending about a quarter of it on the pretence of building the well and pocketing the rest.

30. *Q.* Do you think they really would do that?—Yes.

31. *Q.* (*Mr. Muir-Mackenzie.*)—You could get over that by making the advance in instalments; could you not?—Yes, to a certain extent, but it is very difficult very often to say how much a man has spent; and as far as I can see, it is impossible to estimate in some cases definitely what a well is likely to cost unless you know exactly the substrata and the depth you will have to sink.

32. *Q.* (*The President.*)—Would you advocate having boring apparatus at the head-quarters of each district to be lent out when required?—You would also have to have a trained staff to work this boring apparatus.

33. *Q.* There is a man now attached to the Agricultural Department for this purpose. Would it be a better thing to have several men attached to the department, say, one in each district?—I think, if you had one man in each district, probably he would idle a good part of his time.

34. *Q.* On the other hand, if the thing was really being seriously taken up, one man for the whole of the United Provinces is not enough?—No.

35. *Q.* (*Mr. Roberts.*)—Have you made use of him?—Yes. I had charge of some Court of Ward's villages in Muttra, and I had up the departmental tube sinker and I tested for the *mota* and I found out the exact depth, and the wells in that place had to go down to 82 feet. It was all sand down to 82 feet.

36. *Q.* (*Mr. Muir-Mackenzie.*)—And you built wells at that depth?—Yes, a well was built. It was completed just before I left Aligarh or just after; I forget which.

37. *Q.* (*The President.*)—It would cost a lot of money?—Yes. It would cost Rs. 800 at least.

38. *Q.* (*Mr. Muir-Mackenzie.*)—Will it be worth the money when you have got it?—Of course there is a limit when it becomes too extensive.

39. *Q.* (*The President.*)—I suppose the water would rise in it?—There are probably 40 feet of water in that well.

40. *Q.* You would not have to bale it up from 82 feet?—No; the water rises up. You often have to take a well so low, not on account of the water level being too low, but on account of getting no foundation.

41. *Q.* Then, as regards questions 23 to 33, I would like to ask you, do you think it would be a good thing for the country if the Canal Department at slack seasons were to fill up *jhils* and tanks?—Yes, but it depends on the locality. In some places the water level is high and the country is water-logged, and there it would be a bad thing; but there is a part of Aligarh District in the south where the water level has been sinking continually for years and where many masonry wells have become absolutely useless, and there it would be a good thing.

42. *Q.* (*Sir Thomas Higham.*)—What was that supposed to be due to?—I think it is due to the drainage.

43. *Q.* (*The President.*)—To over-drainage?—Yes.

44. *Q.* In your answer you suggest that Bull's dredger will be a good thing to have?—Yes.

45. *Q.* Is Bull's dredger used much in sinking wells?—The Hathras Municipality sometime ago sunk a well in the Town Hall compound, and one of the *banias* in charge of it borrowed a Bull's dredger for the purpose from Aligarh. They excavate the sand much quicker; the native *jham* is just a sort of *kachcha* arrangement.

46. *Q.* (*Sir Thomas Higham.*)—It depends on the depth. I think that the *jham* is better for a certain depth.

(*Witness.*)—Is it?

47. *Q.* (*The President.*)—In reply to question 41 you discuss the taking away of canal irrigation from people who have already had it and on page 39 you say "of course the owners would have to be compensated for the withdrawal of canal irrigation, and this should be done on a liberal scale." Do you contemplate under certain circumstances that it would be expedient to take away irrigation from people who have once had it?—I think I have said somewhere that until you know the relative position of the *mota* you cannot say what effect the taking away of canal irrigation would have on the practicability of wells, and if you had a regular survey made, you might be able to say for certain that the water level in certain tracts might enable wells to be conveniently sunk and deeply. In that case it seems to me such a waste of canal water to use it where you could get a sufficient supply from wells.

48. *Q.* We have a problem now before us in certain parts of the Punjab where there was fully developed well irrigation which was superseded by canal irrigation which has been going on for 50 or 60 years?—I should think, even if you had to pay down a good sum in cash compensation, it would be a good thing for the country probably to take it away.

49. *Q.* (*Mr. Muir-Mackenzie.*)—Of course that would be a matter as to what compensation you could give. But you also have to see that the other country does not deteriorate seriously?—Yes. And you ought to have these things surveyed beforehand to see what effect any change will bring about, because in Meerut the Settlement Officer, Mr. Burkitt, told me that a large number of *kachcha* wells had become impossible in tracts where they had been before possible owing to the canal.

50. *Q.* Were not these tracts saved by the canal?—Yes. No doubt the people themselves find the canal irrigation is cheaper than the well irrigation. Canal water is almost worth its weight in gold, and it seems a pity not to send it where it really is absolutely necessary.

51. *Q.* (*The President.*)—Would you systematically restrict the irrigation of a district to 30 or 35 per cent., or some figure of that sort?—That is a very difficult question. I was looking at the statistics of Ghazipore for the last year's *rabi* when there was no *hathia*, no Christmas rain, and, in fact, no rain at all; and I found that at least nine-tenths of the area in the places where irrigation was possible, except

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on the alluvial soil, was irrigated, and I know if there had not been that irrigation, on the unirrigated land there would have been practically no crop.

52. *Q.* What is the irrigation done?—Almost entirely from wells.

53. *Q.* Of course that is very different from bringing in outside water?—Yes.

✓54. *Q.* In the Aligarh District there is a great deal of *oosar* and *reh*?—Yes.

✓55. *Q.* Have you ever seen cases where land has been reclaimed by drainage and brought back to cultivation?—Yes, Aligarh was my first district in India; I went there in 1886. I remember the camping-ground at Khair then. Most of it was *oosar* with salt efflorescence, but when I went back five years ago I could hardly believe it was the same place. All the salt efflorescence had gone and grass was beginning to grow on it. There was a great difference in it.

✓56. *Q.* (*Sir Thomas Higham.*)—Was it cultivated at all?—The cultivation was gradually spreading and one man applied to me for a lease of some of that land, which before had been absolutely impossible.

✓57. *Q.* (*The President.*)—There used to be a great deal of trouble in the old days, 25 years ago, on the east Karon Nuddi from water-logging and swamping. Has that been improved?—Is that in the Aligarh District?

✓58. *Q.* (*The President.*)—Both in Bulandshahr and Aligarh?—There was no complaint about water-logging in Aligarh when I was there.

59. *Q.* You have had a good deal of experience in Aligarh of the relations existing between revenue and canal officers?—Yes.

60. *Q.* Do you think the present system works well?—I think so. I don't think it could be bettered.

61. *Q.* I daresay you know that in the south of India the whole charge of the irrigation really rests with the revenue officers, and that the canal officer does the technical part of supplying the water in certain distributary channels and so on. The whole of the minor distribution and arrangements as to where the water is to go rests with the Collector and his staff. Do you think that an improvement?—The present system seems to work quite satisfactorily and I don't know whether the other system would. Unless it is supposed there are any particular advantages to be gained, I would leave well alone.

62. *Q.* In Ghazipur the irrigation is by wells?—Almost entirely by wells. There is a certain amount of tank irrigation too.

63. *Q.* Does Ghazipur run out to Nepaul?—No.

64. *Q.* (*Mr. Roberts.*)—*A propos* of what you were saying about the system of revenue collections for the canal irrigation, I have noticed occasionally in cases which come up to the Board; a great discrepancy between the canal *jamabandi* and village *jamabandi*. Do disputes arise as to the rates due and is there any difficulty about that, or are these only exceptional cases?—I don't think there ought to be disputes, because when the canal *amins* go to measure the irrigated area, the *patwaris* are supposed to go with them, and the *patwari* signs the canal *amin's* measurement, so that if there is anything wrong, they are supposed to reconcile them on the spot.

65. *Q.* Would the cases be rare then; do you think?—They are exceptional; they are due to disturbing influences.

66. *Q.* (*Mr. Rajaratna Mudaliar.*)—Could not the measurement and assessment be left to the *patwari* who has to go over the fields in preparing his statistics?

(*Mr. Roberts.*)—But here the canal authorities are furnished with the *patwaris'* papers and they have to go on that.

67. *Q.* (*The President.*)—Do you find complaints made against Canal Deputy Magistrates as being one-sided in their judgments?—No. I think my experience is that Canal Deputy Magistrates are generally extremely lenient.

68. *Q.* (*Sir Thomas Higham.*)—With reference to your reply to question 4 that "land irrigated from works constructed by private capital is exempt from enhancement of assessment during the currency of the settlement next following the one in which the improvement was made." Do you mean to say exempt from all enhancement at all?—It is supposed to be exempt from enhancement for the increased rental due to the irrigation improvements.

69. *Q.* With regard to your remark that a total remission in case of failure to obtain water ought not to be recommended, do you think there is the same objection to a partial remission?—It is so difficult to say when a man has taken a loan whether he has actually spent the money for the object he has taken it for, or whether his object in taking the loan was to save a part of it and to get the whole loan remitted.

70. *Q.* Is it possible to make the advances by instalments?—Yes, that is what is generally done.

71. *Q.* That is to say, you give a man one-third of what he asks for?—What I generally do is to decide first how much is to be advanced, and then I give him probably one-half of that, and when it is reported that he has done work to that value, then I advance him the rest.

72. *Q.* Is not that security against their taking more than they want for the work?—It would be if you could be certain how much money had been actually spent, but you have to rely on the report of your subordinate, who is not a trained man.

73. *Q.* Do you find that when wells are made that assistance is given in the village?—Yes, if a tenant makes a well, the other tenants will generally help him with labour and so on.

74. *Q.* That is one reason why wells should always be made by the people?—Yes; and not only that, but they do it very much cheaper than we can.

75. *Q.* You talk about dredging the *jhils*?—Yes. I mean digging out the earth that gets deposited in them.

76. *Q.* That would be a very costly business?—Yes.

77. *Q.* As regards the question of withdrawing canal irrigation from villages in which it is desirable, you suggest, that it would be well to pay compensation in such cases?—Yes.

78. *Q.* But would any compensation be acceptable to the people themselves? Would they be willing to give up their canal irrigation?—I think whenever anything is done compulsorily it is unpopular. If you take up land for a railway, there is always somebody who complains that he has not received his full compensation whether he has or not.

79. *Q.* Do they ever give up their canal irrigation in villages and take to wells?—I don't think it has ever been tried. I think there is an order of the Board saying that canal irrigation will not be withdrawn arbitrarily.

80. *Q.* Do you think canal irrigation could be restricted by increasing the rates in such tracts?—I think that is probably the most practicable method of doing it, because then the people who could use wells would do so, and the people who could not use wells would go on using canal water.

81. *Q.* They would have to make new wells?—It would depend on how long the canal had been working there. In some places there are old masonry wells which are still existing, but where *kachcha* wells were made before the canal was made, of course these have all long since fallen in.

82. *Q.* Would they make *kachcha* wells again or *pakka* ones?—That would depend on whether the water level had been seriously raised by the canal or not probably.

83. *Q.* Then of course directly you withdraw the canal irrigation, the water level will fall again?—If you withdraw it over a sufficient area, it probably will. The canal would make an alteration in the water level over a much larger area than where it is actually irrigating, because the whole sub-soil after a certain distance is almost pure sand, and as soon as the water reaches that sandy strata it raises the water level for a very considerable distance.

84. *Q.* When you withdraw your canal irrigation you would have another change, and you might have to re-introduce it again?—Probably there would be a certain amount of risk unless you had full data to go on beforehand.

85. *Q.* (*Mr. Muir-Mackenzie.*)—Can you give me any idea whether the number of wells entered in the statistical records might be taken as fairly accurate?—Yes.

86. *Q.* The *patwaris'* papers are practically correct as regards that?—Yes, very fairly so.

87. *Q.* That is to say, the number of wells used. If a well is not, it will not be shewn in the statistical records, which were new and which were old, that was not very easy to find out apparently?—You could see up to a certain year that only a certain number of wells, say, 25, had been actually used, and if, at the present day, you saw there

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were 45, the chances are there would be 20 new wells. And then you could look up the old settlement records to see which particular fields those wells were in, and you could always locate them.

88. *Q.* You had no difficulty in ascertaining from the *patwaris'* papers that there were a certain number of new wells. Your difficulty was to find out where they were?—On settlement work I had to inspect seven square miles of country every day. If you had sufficient time, of course you could find them out without any difficulty, but it would save you so much time if the people themselves came up and said there were such and such new wells.

89. *Q.* You say the fear of enhanced rent does prevent the tenants from making wells; are there no other difficulties? For instance, does the landlord not require his permission to be obtained?—I think in a considerable number of cases in Aligarh and Bulandshahr where the landlords had a great dispute with their tenants, they do not like their tenants to be at all independent, and I am quite certain that they often do their very best to prevent tenants making masonry wells.

90. *Q.* What would they do to prevent them?—The landlord has a great hold over his tenants. If they are not occupancy tenants, he can eject them, and even if they are occupancy tenants, a rich man can harass them in a thousand different ways.

91. *Q.* Quite sufficient to deter them from making wells?—Yes.

92. *Q.* Therefore may it be taken that in a great many instances, unless the tenant can square his landlord, he will have great difficulty in making wells?—Certainly, I think so; I have seen a tenant come up to the son of the Raja of Morsan and ask him to allow him to make his well *pakka*, and the Raja has evidently refused to allow it.

93. *Q.* (*Mr. Roberts.*)—And he is a fairly intelligent landlord?—Yes; I did not like to interfere between the landlord and the tenant, because I felt a tenant was so completely in the hands of the landlord that I should be encouraging him to his own loss. That was under the old Rent Act. This new Rent Act has put things on a much more satisfactory basis.

94. *Q.* (*Mr. Muir-Mackenzie.*)—That is to say, it will enable the tenant to resettle the rental. But won't the landlord always be able to harass him?—Any way the tenant now knows he has a legal right to do it, whereas under the old Act it was not definitely laid down. You could only prove it by implication from various other sections.

95. *Q.* Now he knows he has a right to make an improvement?—Yes.

96. *Q.* Now in the districts with which you are acquainted, do you consider that it is possible to multiply the number of wells largely with advantage?—In Ghazipore I was lately looking up the statistics, and I find that in the last *rabi* season very nearly the whole area that could have been irrigated was irrigated from wells, so I don't think there is any great necessity for extending irrigation there.

97. *Q.* How did you judge what area was capable of irrigation from wells there?—There are certain tracts of country, the alluvial valley of the Ganges, where the substrata is almost sand for an unknown depth, and there wells cannot be made and are not used; and, as a matter of fact, these tracts do not require irrigation, because the soil is very retentive of moisture; but I found in pergunnahs away from the river that nearly the whole of the rabi area had been actually irrigated from wells.

98. *Q.* Therefore they don't want any more?—Yes, of course the more wells you have, the more careful your cultivation can be. You can grow more garden crops where you have numerous wells than where there are few.

✓99. *Q.* Is not there a certain amount of tank irrigation?—You can more or less divide the district up into three tracts and three classes of soil. The first is the alluvial tract, in which irrigation is, I should think, unnecessary and generally impossible; (2) the ordinary tract of loam without any *oosar*; the greater part of which is irrigable by wells; (3) *oosar* tract in which rice is the principal crop, you cannot irrigate rice from wells, because it wants too much water; and you cannot grow *rabi* there. The only thing for that is to make embankments to hold back the water in nullah and depressions.

100. *Q.* Is there much scope for increasing the number of embankments?—The great difficulty in the way of that is that the land is very much sub-divided among many villages. In each village there are a very large number of co-sharers, and you can never get these men to combine; two or three people may hold out and then the other people will say "we are not going to improve so and so's land at our own cost," and thus nobody does it.

101. *Q.* Do you see any remedy for that?—The law gives legal powers to compel partition if people desire it against the will of the others, and they have to pay up. It seems to me the only way of getting irrigation improvements through is to give legal powers to let a man apply for authority to make an improvement and charge the proportionate cost to the others. Of course that would be a very difficult thing to do.

102. *Q.* (*Mr. Roberts.*)—Apart from the quarrels of the shareholders, is not there another difficulty in improvements of that kind; for instance, if you make a *bund* in one field and other fields suffer from that *bund*, the people say "why should we lose six pence in order that the others may gain a shilling"?—Yes, it is a very difficult question. I had a case in my own experience the other day. There was a village in which the Court of Wards had a share and a large quantity of land had gone out of cultivation simply owing to a large embankment that had been made having been rendered useless by the escape being washed away, and I did not see why I should improve the whole village at the expense of the Court of Wards. So I had up the other co-sharers and I said to them "this is a very necessary work," and they all agreed that it would be a very good thing if it was done. I said to them "if all the co-sharers will join the Court of Wards in raising a loan, I am quite ready to give you the necessary *takavi* to do this work; only I am not going to do it at the whole expense of the Court of Wards. If you want it done, you must all join in and give security jointly." Although I had made arrangements with a certain tenant who, they suggested, was the right man to do the work—I quite agreed to that; in fact, I agreed to everything they said,—not one of them would come forward and apply for *takavi*.

103. *Q.* And the work was left undone then?—Yes, that village is in a very bad way, so much so that we have got a lot of land on produce rents there, and the tenants will not sow it, nor will they relinquish it, and that ground is bringing us in absolutely nothing.

104. *Q.* (*Mr. Muir-Mackenzie.*)—That was owing to this work having fallen into gross repair. Was it nobody's duty to keep that work in repair?—It belonged to the co-sharers, and it was their business to look after it.

105. *Q.* It was their duty?—It was not a legal duty, but it was to their interests to keep it in repair.

106. *Q.* Is there no custom to the effect that the zamindars should keep these works in repairs?—I think generally not. In one or two arbitration cases that came to my notice it has been decided that the zamindar has to construct a certain work and in time of need all the tenants must turn out and keep it in order.

107. *Q.* How was that decision arrived at on the custom of the country?—No. It was a case in which a zamindar had applied for enhancement of rent from a large number of tenants in his village and they had all agreed to refer the dispute to arbitration and the arbitrator came to this decision.

108. *Q.* You don't think there is any definite custom in regard to such matters?—No, I don't think there is.

109. *Q.* Can you make any suggestion for keeping these works in a more efficient condition?—Without some form of compulsion and unless you can invest some one with legal authority to do a work and charge part of the cost to the other people, I don't think anything can be done. It seems to me also that the ordinary natives of the district don't seem to understand how to make overflow weirs. I believe, if they were shown one or two over flow weirs, it is quite possible some of them might come forward and follow the example.

110. *Q.* Have you river channels at all in Ghazipore?—No.

111. *Q.* In order to fill up the tanks you have not what they call *pains* in Bengal?—I don't think so. There are no embankments thrown across river channels if that is what is meant.

112. *Q.* You don't lead off the water by small channels from the streams?—No. The lift is too great to make it worth while. Of course they lift water out of tanks.

113. *Q.* (*Mr. Roberts.*)—In Ghazipore you have only one or two streams that could possibly be bunded?—Yes.

114. *Q.* (*Mr. Muir-Mackenzie.*)—To go back to the wells, when a tenant makes a well, of course, the landlord gets no enhancement of rent?—He is supposed not to.

115. *Q.* Do you think he actually does?—I don't know. I have not come across cases of that sort. I should certainly knock off part of the enhancement if a case came before me, if a tenant has effected an improvement himself.

116. *Q.* Do you think he gets it by agreement?—It is very difficult to say.

117. *Q.* Had you made any land revenue settlements?—Yes.

118. *Q.* You did not allow for any enhancement of rent on account of wells, I presume?—The way I did it in Lucknow was to take the total assets as they appeared to be, and then to say there are so many new wells, and then I gave a lump reduction on those assets.

119. *Q.* Whether the well was made by the tenant or the landlord?—The object was to keep the enhancement down as low as possible, so I did not make any particular enquiries as to whether a well was made by the tenant or landlord.

120. *Q.* If you had not been wishing to keep down the enhancement, you would have had to make some distinction?—I am not quite certain what the Board circular says, or whether it distinguishes between the tenants' and the landlords' wells. If you are assessing on recorded assets the tenant has probably already got his reduction, because his rent has not been raised. If his rent has not been raised, he has already got the full benefit of it and therefore you don't allow anything on the revenue.

121. *Q.* Does the circular distinguish?—Yes, it does.

122. *Q.* Therefore when a tenant makes a well at the next settlement, Government will get no increase of revenue on account of that well; would it?—Unless his recorded rent has risen in the meanwhile.

123. *Q.* And any rise in his rent ought not, if the law has been observed, to be due to the wells?—No, it ought not to.

124. *Q.* On the other hand, if a landlord makes a well, Government will get an increase of revenue at the next revision of settlement?—Yes.

125. *Q.* If the tenant makes a well, Government gets no enhancement if the rent has not been raised. If, on the other hand, the landlord makes a well, Government does get an enhancement?

(*Mr. Roberts.*)—Under the Act the rent of an occupancy tenant cannot be enhanced on the ground of any improvement effected by the tenant himself.

126. *Q.* (*Mr. Muir-Mackenzie.*)—Referring to the previous question of extending wells in Ghazipore, you did not think many more were wasted. What about the other districts? Can wells be largely extended, for instance, in Aligarh and Lucknow? Do you think many more wells would be made with advantage in these districts?—I knew nothing about wells when I was in Lucknow, so I can say nothing about the Lucknow District, and in the Aligarh District I think there probably is a considerable scope for increased well sinking, but there is this danger to be feared that if you increase the drain on the sub-soil water-supply, it is quite possible it may fail.

127. *Q.* Have you ever formed any ideas as to how close you can make wells together in any part without trenching largely on the sub-soil water-supply?—If you put one well down here and another well down, say ten yards off, I don't believe that it will affect the head of water to any considerable extent; at least not the permanent supply; but in a large tract of country, if you were to put down a large number of wells and work them altogether, then there is no doubt, I think, that the water level would fall.

128. *Q.* You have not come to any idea as to the limit as to whether you could work one well in 10 or 20 acres?—That would chiefly depend on the depth of the water level above what they call the *mota*. Working a well depresses temporarily the water level in the well. This depression of the water level is necessary to give the head necessary to drive the water through the sub-soil into the well and may be styled depression head. If the normal depth of water in the wells of a tract was very considerable, say thirty feet, it is probable that any number of wells could be worked in that area without reducing the normal water level to a point at which the necessary depression head would not be available. If, however, the *mota* in a tract of country is submerged to a depth that leaves only a small margin beyond the necessary depression head, a large increase in the number of wells would probably be useless, because the fall in the normal water level of the tract would reduce the depth of water in the wells to something less than the depression head necessary to give the wells their proper supply.

129. *Q.* It is a very difficult thing to fix the limits; it depends on the particular circumstances of each tract?—Yes, but one or two wells close to each other, I don't believe do interfere. I have seen wells working very close to each other.

130. *Q.* What average do you say wells irrigate in Ghazipore; 11 acres?—I have just worked it out. It is on an average about 11 acres that a well will irrigate in a year.

131. *Q.* Did you work that out from the statistics?—Yes.

132. *Q.* Do you think they can be relied on?—Yes, fairly so.

133. *Q.* Have you such a constant check upon the *patwaris* that you can rely on them? I ask you this because in my own province, Bombay, this is very badly done?—The *patwari's khasra* is checked by several officials. Every well that is irrigating is supposed to be marked in a certain column and these are totalled up.

134. *Q.* Do you really think the check is well carried out?—I think it is fairly well carried out.

135. *Q.* (*Mr. Roberts.*)—When were the papers last revised in Ghazipore?—In 1882. In 1882-83 a regular settlement survey was made in Ghazipore, and everything was done under the supervision of the Settlement Office. Since 1882 the Ghazipore papers are as correct as they can be.

136. *Q.* (*Mr. Muir-Mackenzie.*)—You suggested that if necessary a survey of the *mota* of all the wells should be made. Would that not be an operation that would take up an immense amount of time and expense?—It seems to me that it is really not a very difficult thing. I don't see why the *kanungos* should not be trained to do it.

137. *Q.* Trained to use the boring machines?—No. In a large proportion of cases the position of the *mota* is accurately known; there are only a certain proportions of doubtful cases which you would have to test.

138. *Q.* Your point is, the *kanungos* could do the survey and do it fairly well?—Yes. There would be a certain number of doubtful cases which would require to be tested.

139. *Q.* How long do you think it would take to get a thorough survey of Aligarh?—I framed a sort of general idea in my mind of the way to it. The first thing absolutely necessary is to ascertain the technical terms in use in the different places. When I left Aligarh and went down to Ghazipore I found that the technical terms used in Aligarh were perfect Greek to the people in Ghazipore. I had to make enquiries and found out what the terms were that they used.

140. *Q.* How long do you think it would take?—A very considerable portion of the survey of the *mota* can be made by ascertaining and recording the knowledge possessed by the cultivators and this should not be a long or costly operation. Even where the result of this enquiry proved that a *mota* was not known to exist the knowledge would be valuable. The first step would be to ascertain the vernacular technical terms in use in each district. The second is to train the *kanungos* as to the conditions of the sub-soil required for wells to be successful. The third is to train the *patwaris* through the *kanungos*. The fourth is for the *patwaris* to ascertain by local enquiry and plumbing existing wells where and at what depths the *mota* exists. The results thus obtained would be tested by the *kanungos* and by a few peripatetic inspectors appointed for this purpose by the Land Records Department. From this preliminary investigation the country can be divided into tracts (*a*) where the *mota* is known to exist and where there can be very little doubt as to the practicability of wells or their cost, (*b*) where the *mota* is known not to exist at least down to particular depths which would fix the minimum cost of a well, the maximum being uncertain, the practicability of wells being very doubtful. In my opinion this much could be done for the whole province in about three years. When this had been completed, I would begin tube well experiments and take up by degrees the whole of tract (*b*) except in the following cases: (i) where the minimum cost is known to be too great for well sinking to be financially remunerative; (ii) where the water level is sufficiently high to enable percolation wells to be successfully worked; (iii) where irrigation is already sufficient or impossible owing to the nature of the soil or unnecessary. Until the area to be tested is ascertained, it is impossible to say what these experiments would cost or how long they would take.

141. *Q.* Putting aside famine years, you say Collectors do find some difficulty in getting rid of *takavi*?—Yes, in a great many places they won't apply for it.

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142. *Q.* Who won't apply for it? The Collectors won't apply for it?—No; the people won't apply for it.

143. *Q.* Supposing you found some district undoubtedly capable of a large extension of well irrigation, that is to say, the soil was suitable and you know the tracts in which your *mota* was favourable, and the other conditions were also favourable, do you think that if the Collector or District Officers pushed the matter they could get rid of large sums of money?—Yes, advances would be largely taken.

144. *Q.* Do you think then that one can go so far as to say that to a certain extent it is due to want of push that advances are as small as they are in ordinary years?—At present you are given *takavi* absolutely blindly.

145. *Q.* Do you think it is owing to that, or do you think that the number of officers who really care about the subject is not very large?—I would ask you to look at it from my point of view. I could distribute a large amount of *takavi* if I set myself about it, but I don't know how much Government money I am wasting or how much of that will be utilized. My staff is very bad and inefficient, and I feel at present that I would be doing as much harm as good in distributing a lot of *takavi.*

146. *Q.* Do you think that is what deters a lot of officers?—I think so.

147. *Q.* You cannot ascertain whether the money is properly spent?—Yes, I would like to mention one other matter, if I may. If there is any talk of the Karamnassa Canal, I believe there is a portion of Ghazipore in which it would do some good.

148. *Q.* (*The President.*)—Does Ghazipore cross the Ganges?—Yes.

149. *Q.* (*Mr. Rajaratna Mudaliar.*)—As regards the accuracy of these statistics, I find that in Saharanpore the number of wells in 1899-1900 was about 7,600; in 1900-1901 the number was 6,800, a difference of 800, but the area irrigated has fallen from 72,787 acres to 16,627. Can you explain how it comes about that there is this large drop while the number of wells only decreased by 800?—No; I don't know how that can be explained.

150. *Q.* The same thing occurs in other districts, so that I am inclined to doubt whether these statistics are correct.

151. *Q.* What is the average area irrigated by earthen wells as compared with that served by masonry wells?—It depends; there are two kinds of earthen wells, spring wells and percolation wells; percolation will irrigate only a small area and they are worked by counterpoised levers or "dheukals."

152. *Q.* In a very dry year what would be the average area irrigated by each well?—In Ghazipore last year we had a very dry year and 11 acres was the area irrigated by each well. There are not many wells in Ghazipore which run more than one *mot*; some of the wells are lever wells.

153. *Q.* How many waterings are given to each field?—Last year in Ghazipore they certainly had to irrigate before they sowed and they must have irrigated twice afterwards.

154. *Q.* As regards repairs of irrigation works, you said there was no particular custom as to keeping them in order, but would it not happen that at the revision of settlement the Settlement Officer would have to reduce rents if works are in bad order?—Ghazipore has a permanent settlement.

155. *Q.* But where there is a revision of settlement?—Of course in a district which was temporarily settled the tenants might apply for a reduction of revenue on the ground that their irrigation works were not in proper order.

156. *Q.* And the Settlement Officer has power to grant an abatement of rent?—Yes, generally.

157. *Q.* So that would afford the landlord a strong stimulus to keep the work in order?—Yes.

158. *Q.* As a matter of fact, are there any cases in which such reductions have been granted?—I have not come across any

159. *Q.* As regards your objection to remission in cases of failure of wells, your chief difficulty is in making a correct estimate of the amount spent?—Yes, whether a man is honest or not.

160. *Q.* Could not a tahsildar be entrusted to make a proper valuation?—I think it is exceedingly difficult to estimate the amount spent on wells; in the first place a considerable portion is under water and the bottom of the well may have been choked up with sand; you may be wrong as regards the depth of the well; then some masonry is first class and some second class. Tahsildars and even Collectors do not know the rates and find great difficulty in saying what is the cost.

161. *Q.* Could not the Public Works officers be asked to help in the matter?—They have a very fair amount of work to do already.

162. *Q.* But these cases would be rare?—Yes, perhaps.

163. *Q.* This point has been very strongly insisted upon in other provinces?—If you make a trial boring with a tube well, you can make certain at what depth water will be met and the cost, etc.

164. *Q.* But if you had, say a hundred applications, that would be very difficult?—It would be cheaper to spend more money in getting apparatus and making certain of the substrata than to spend, say, Rs. 500 on each well which may be absolutely wasted.

165. *Q.* In giving advances do you think it is absolutely necessary to find out the cost of the well?—I think so, because a man may know the cost will be Rs. 200 and think this will be a good chance of getting Rs. 400.

166. *Q.* You don't lose by giving the Rs. 400 so long as the security is good; what is the necessity for these inquisitorial enquiries; the idea is to encourage the construction of wells. As a matter of fact, do the people ever apply for larger sums than are necessary; are they not afraid of being indebted to the *sircar*?—I am afraid I have not sufficient touch with the people to be able to say.

167. *Q.* Do you experience any difficulty in recovering loans?—There is sometimes very considerable difficulty.

168. *Q.* Due to what?—I think it is due to proper consideration not having been given at the time the loans were advanced.

169. *Q.* (*Mr. Muir-Mackenzie.*)—Still if all is recovered?—This year I have sent up two or perhaps more proposals to sell up hypothecated land for famine advances. Comparatively small amounts have been written off as irrecoverable.

170. *Q.* (*Mr. Rajaratna Mudaliar.*)—Is the loan a first charge upon the land, or does the landlord's rent take precedence over it?—I think it is a first charge except on the actual produce of particular fields.

171. *Q.* Is the debt due to money-lenders recognized?—If the money-lender has a mortgage which is prior to the *takavi* loan, of course the money-lender's loan takes precedence.

172. *Q.* Precedence over the Government loan?—Yes.

173. *Q.* Do you not take encumbrance certificates before granting loans?—Yes, it is supposed to be done.

174. *Q.* If land is previously encumbered do you refuse loans?—Yes, unless it is only encumbered to a very small extent.

175. *Q.* On lands irrigated by wells are there differential rates of rent with reference to the crops raised?—Not in Ghazipore District; in some Court of Wards' estates an extra charge is laid on sugarcane.

176. *Q.* Not on other crops?—No.

177. *Q.* (*Mr. Roberts.*)—As regards *takavi*, advances are given for *pakka* wells?—Yes.

178. *Q.* Are advances made to tenants or landlords?—Generally to landlords, but sometimes to tenants who can give landed security.

179. *Q.* It is generally made to landlords?—Yes.

180. *Q.* As a matter of fact, have the existing wells been built by tenants or landlords?—I have come across a great number built by tenants; I think tenants sink quite as many as landlords.

181. *Q.* Dividing zamindars into cultivating and non-cultivating, which is it that build wells?—Cultivating.

182. *Q.* The larger landlords who live on rents don't build wells?—No; wells are built by tenants and cultivating landlords.

183. *Q.* And advances are mostly made to non-cultivating landlords?—Yes.

184. *Q.* What security can a tenant give for a well costing Rs. 300 to Rs. 400?—In Ghazipore they can give fixed rate holdings; other tenants have no security unless they have a share in some proprietary rights or unless they can get somebody to stand for them.

185. *Q.* Occupancy tenants' rights are not transferable?—No.

186. *Q.* A simple occupancy tenant on his holding has practically no security to offer for a large loan?—No.

187. *Q.* Is that not a great difficulty in the way of a proposal to increase *takavi* for building wells?—Yes, unless you make occupancy holdings saleable.

WITNESS No. 7.—MR. G. R. FOX, Manager, Court of Wards, Ghazipore.

Mr. G. R. Fox.

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1. *Q.* (*The President.*)—You are Manager of the Court of Wards in Ghazipore, I understand?—Yes.

2. *Q.* Have you been long there?—I have been in the Ghazipore District and Ballia since 1877 and in the adjoining district, Shahabad; altogether 33 years.

3. *Q.* (*Mr. Roberts.*)—You have also had experience of indigo and zamindari in Dumraon?—Yes.

4. *Q.* (*The President.*)—The irrigation in Ghazipore is entirely from wells?—From wells, tanks, and small *nuddis.*

5. *Q.* Are they bunded up and utilized?—There is not much bunding; when they are flowing at the beginning of the cold weather, the people irrigate in various ways by means of lifts.

6. *Q.* Did Ghazipore suffer much in the last famine?—In 1896-97 there was considerable distress.

7. *Q.* Were there relief works?—No permanent relief works.

8. *Q.* Can you, with your experience, suggest any measures which Governments might take to induce people to take larger grant of *takavi* to improve their lands?—My experience in the Court of Wards is that, although we have been instructed to treat the tenants liberally and give them *takavi* for wells, the results have not been satisfactory; tenants don't come forward freely.

9. *Q.* Is there any difficulty about recovering the money?—Not in the Court of Wards; we are careful beforehand about lending money. Sinking wells by oneself is not satisfactory on any considerable scale over scattered areas and tenants don't readily co-operate with one, and if you employ subordinate agency, there are complaints.

10. *Q.* Is there apathy or indifference to the subject on the part of tenants?—They are apathetic. Well sinking of course means that a man must be well off.

11. *Q.* Even if he borrows from you?—Yes, he needs his neighbours to help with their bullocks and labour. For a poor tenant the undertaking is a difficult one, and those better off are more or less indifferent as to taking *takavi.*

12. *Q.* I can understand your feeling that the Court of Wards should not build wells, but could it not be done by small zamindars?—Yes, a small zamindar is resident on his own place and could supervise it. As Court of Wards Manager, I have to go a round 160 miles long. I know, if I asked for Rs. 5,000 to Rs. 10,000, the Board, after satisfying itself as to the necessity, would send the amount, but the difficulty would be as regards getting reliable tenants to take it up.

13. *Q.* What remedy do you suggest in this state of affairs?—My idea is to utilize the natural lakes and streams.

14. *Q.* They would fail you at the time of drought and famine?—There is a very big lake, the Sura Tal, in Ballia which would *not* fail in times of drought, as the Ganges floods fill it *every* year. Reference is made to it in the Gazetteer by Mr. Oldham; that receives the drainage from the west and overflow from the Ganges.

15. *Q.* What was the scheme?—To put weirs across the outfall *nadi.*

(*Mr. Roberts.*)—The Sura Tal is a large lake connected with the Ganges by a little nullah. It has a fairly large catchment area; every year the Ganges rises it gets full of water. The idea was to put a weir and some Engineers were sent who elaborated a scheme, but some engineering objections were raised which I don't know about. But still greater objections were raised on the part of the zamindars who surround the Sura Tal. The bed of the Tal is extremely productive and an enormous area of gram can be sown. If it is a good rainy year, they get rice, and if dry they get gram. As the scheme was intended to benefit people beyond, the zamindars on the lake raised objections to it.

(*Witness.*)—The main objection recorded in the Gazetteer is that local funds would not permit of it. As an instance of what can be done by a small work, I may mention that a small *bund* was made by me costing Rs. 30, and the people said there were 2,000 *bighas* of sugarcane benefited by it; this is what could be done in Ghazipore and Ballia. But our local zamindars would not have been able to do that. Jealousies of neighbours bar the way. The people round about put an objection into Court every year against my *bund*; if the thing had been done by their neighbours in another village, they would have taken more active measures.

(*Mr. Roberts.*)—Ghazipore has never suffered from famine; it has had distress.

16. *Q.* (*The President.*)—We found considerable distress in Saran which is not far off?—The higher lands in Ghazipore and Ballia have a short rainfall and the people suffer considerably.

17. *Q.* Have you any suggestions to make which you think would be of value to this Commission?—My suggestions are in the direction of utilizing natural lakes and the smaller streams. Of course the bigger streams and rivers like the Karamnassa, Gumti and Sarju do not come into that. There are half a dozen of the smaller streams as you go from Benares to Turtipur, crossed by the Bengal and North-Western Railway.

18. *Q.* How long do they keep running?—We had fairly late rains this year and so they have water in them now.

19. *Q.* What would you utilize them for?—I would have big weirs which would retain Ganges flood water which is certain as well as the uncertain rain.

20. *Q.* Would the people take irrigation every year?—I think they would irrigate every year and to a larger extent in dry years.

21. *Q.* We found that on the Sone canals people have settled down to irrigation, but in Saran they will only take it in one year out of four or thereabouts?—My answer is that, if Government is to take the responsibility for protective works, they must do it, and if people don't utilize the water put on a rate. My opinion is that the Sone canals were simply a gift to the zamindars. [Saran has a sub-soil moisture which the higher lands of Ghazipore and Ballia do not possess.]

22. *Q.* Would you impose a water-rate on the area irrigable?—Yes.

23. *Q.* How much would it be?—Rs. 4 or 5 per acre can be borne.

24. *Q.* If it is done only once in four years, there would not be much capital outlay required?—Take into account what it costs to make a well; in Ghazipore my experience is that wells cost anything from Rs. 100 to Rs. 600 and the interest only would be Rs. 4-8 per acre on an average.

25. *Q.* They get the benefit every year?—Yes, more or less; in a dry year there is not the same duty; well irrigation is no use for rice.

26. *Q.* Suppose people only take water once in four years, should they pay a yearly cess?—Yes, I don't see how Government could finance it without that.

27. *Q.* Then would you lay it on absolutely without consulting them?—Yes, I should.

28. *Q.* A rupee an acre?—The cheaper we can do it the better, but they can pay more.

29. *Q.* Although the water was only used once in four years?—They would use it oftener. My idea is that flow irrigation is a mistake; lift is better. From my experience in Ghazipore and Ballia I should say they would take it every year. It is not a question of water not being utilized.

30. *Q.* Do the *nuddis* there look practicable *primâ facie* for canalizing?—Yes, some. In some cases the lift would be 20 feet; in no case more than 25 feet, and wells go down to 50 and 60. A *kachcha bund* might be constructed. I would now here add that I suggest one small scheme being undertaken as a test one so as to put such schemes beyond discussion; take up the Sooraha Tal scheme on its full or limited lines and so practically demonstrate its success or failure; with the worst results the test is worth the money lost.

31. *Q.* I suppose there would be a storm of indignation from the people below the *bund*?—They would put in a claim.

32. *Q.* Have you had much experience of failures in sinking wells?—Yes, a good deal of that has happened. They have a very primitive way of going to work on a well, and often the sand or *kankur* proves too much for them, or the well gives out after a time through an inflow of sand.

33. *Q.* That is pretty frequent?—Yes.

34. *Q.* The only thing is to build another well inside it?—If the old well is sound, it is often cheaper to build

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another one elsewhere, when the old well is found bad in any way.

35. *Q.* We had a very bad account of things in the Bhabua Division?—To show you what the cultivators will do. Many years ago there was a howl about the Sone Canal, and Mr. Mylne of Bihia went down with the Viceroy, Lord Northbrook, and informed the cultivators that they had come to shut off the canals, as there had been so many complaints about them; the men at once put up their hands and implored that this should not be done; that they would get along somehow, but not to shut off the canals. [I would here add that it might be well worth Government meeting some of the innumerable objections of Sone Canal tenants and zamindars by shutting off irrigation in certain given parts and giving more water further down the canals; the experience obtained by such a course would be invaluable and could lead to a large increase of canal revenue, I am convinced, from the lands further down the canal.]

WITNESS No. 8.—MR. E. HILL, Manager, Court of Wards, Partabgarh.

Mr. E. Hill.

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1. *Q.* (*The President.*)—You have carried out some irrigation works in Partabgarh?—Yes; 26 years ago in 1875, Captain Chapman asked me to take up one; there was a lake of 5,000, *bighas* and a depth of water of 7 feet. I drained off the superfluous water and arranged to use the spare water for irrigation. I carried out the scheme at the time and now it has again come under my charge as Manager of the Court of Wards.

2. *Q.* Was it a success?—Yes, it was and is, although the land has deteriorated a good deal. By using sluices water can be run in from or out into the Ganges.

3. *Q.* Is that in Partabgarh?—Yes, I have a 12 H. P. engine and a centrifugal pump lifting water from the Ganges from which I can irrigate 25 acres a day, and there are two other pumps for pumping off superfluous water to admit of sowing. An area of 300 *bighas* is reserved, which I utilize for water to irrigate crops round the margin with.

4. *Q.* Is it rain or river water?—Sometimes river sometimes rain water. This year there was no occasion to bring in Ganges water.

5. *Q.* You cannot utilize what you run off?—I utilized a good deal of it for irrigation.

6. *Q.* Have you got small distributary channels?—Yes, the engine pumps up water 10 feet and channels are run round the lake.

7. *Q.* How much irrigation do you do every year?—About 1,500 *bighas*. When rice is short of water, I irrigate it from the engine.

8. *Q.* Do you grow indigo?—Before we did; now it does not pay.

9. *Q.* Do you grow sugarcane?—No.

10. *Q.* Have you ever made any calculation as to the cost per *bigha* of this irrigation?—The first cost of the engine, pumps, and distributaries I do not count. I irrigate 1,500 *bighas* at 12 annas a *bigha*.

11. *Q.* Does that include the cost of fuel?—Rs. 600 is given for fuel for engines; I supplement that with wood and *jhan*. Coal is principally used.

12. *Q.* (*Sir Thomas Higham.*)—How high do you lift water?—Ten feet.

13. *Q.* Is that 12 annas a *bigha* simply pumping expenses?—Yes, I have a native *mistri* on Rs. 20, one mate, Rs. 15, and another on Rs. 10; they do steam ploughing in the hot weather. I plough rice lands as they get foul; that is separate.

14. *Q.* (*Mr. Roberts.*)—The original works were not expensive. There is only one big sluice?—Yes.

15. *Q.* This is the only masonry work?—Yes.

16. *Q* (*The President.*)—Besides these 1,500 *bighas* that you irrigate, I suppose you irrigate by wells?—All other irrigation in my district is done by wells. I am a great believer in wells.

17. *Q.* Have you made wells yourself?—Yes, I have myself made several hundred masonry wells.

18. *Q.* We have heard that it is much better to get tenants to make the wells themselves?—Yes, I think it gives a man more interest in it. I give them wood for burning bricks free and also *takavi* at a low rate of interest. I have two very impoverished estates where there are hardly any *pakka* wells; the proprietors would not allow wells to be made except on receiving heavy *nazrana*; I had last year 18 *pakka* wells made on these two estates by the tenants.

19. *Q.* How deep is the spring level?—On an average 40 feet.

20. *Q.* How much do you count can be irrigated by one of these wells?—40 *bighas*; I reckon as my standard a well of 8-foot diameter; that allows 8 pairs of bullocks to work with 18 buckets, 2 on each face of the *jagat*. I don't use mortar; I find the tied brick system the most elastic; each brick is bound in its place with grass string. The cost of one of these wells is between Rs 500 and Rs. 600. The average spring level is 40 feet, but anywhere within 3 miles of the Ganges you have to go down 70 feet. I am a great believer in preliminary borings; that saves one a great deal of work; you expect to go down 70 feet and may strike water at 45. I think that every estate should have a set of boring apparatus, and, if possible, a man to work it; it is very easy to train a man to it.

21. *Q.* Do you think one man in a division would be enough?—No; the Revenue Department say there are a great many applications for them.

22. *Q.* There is only one man in the whole province. Is there work for a man constantly?—I could keep a man going all the year round.

23. *Q.* (*Mr. Roberts.*)—Do you require more wells in Badri?—No. In Benares natives were constantly borrowing the apparatus. The average area of crop irrigated from an 8-foot well is 40 *bighas*; the area will be irrigated in 60 days; 8 pair of bullocks doing a *bigha* and a half a day; in the famine year not more than half this could be done. The percolation level at present is 20 feet from the surface and that helps the spring level very well indeed; it passes through between the bricks. In a famine year they put down *chaina*; an 8-foot well would keep 16 *bighas* of *chaina* going; the average depth of water drawn is 40 feet in an ordinary year and 50 in a famine year; 60 feet is the *mot's* level and 2 feet the water level.

24. *Q.* How much does the water rise?—Up to 20 feet. When you come to work it, it goes down to 40 feet; the first 20 feet deep are soon used up.

25. *Q.* (*Mr. Muir-Mackenzie.*)—Do these wells you speak of belong to one rayat or several?—They generally belong to one man, but are used by all the tenants. There is a regular custom of joint working by all the tenants, called *hunda*. Say that a man subscribes 2 pair of bullocks and gets the water of the whole 8 pair of bullocks for one day; he would have to lend his bullocks four days; another man lending one pair only would have to work them eight days to get the whole water from the 8 pair of bullocks for one day. This is a very well-worked out system.

26. *Q.* (*Mr. Roberts.*)—Is this peculiar to Partabgarh?—No; it exists in Mirzapur and Benares as well.

27. *Q.* (*Sir Thomas Higham.*)—These wells go down to the clay *mota*?—I sink until I have struck a spring.

28. *Q.* You do not get on to clay; simply go through the sand?—You cannot sink a tied well through sand. You would have it to make a *pakka* steining then.

29. *Q.* You do not rest on a clay bottom?—No; so long as it is fairly sound, I do not try to get down to clay.

30. *Q.* (*The President.*)—How many years do these wells last?—I have seen a number of tied wells which I sunk 25 years ago, which are still working quite well. I have seen them 30 years old, but I should put the life of a well at 25 years.

31. *Q.* (*Sir Thomas Higham.*)—Then what happens?—The steining begins to fall in. The earth is washed away from behind the walls, cavities form and it goes. When I made wells on Court of Wards estates, the rent I put on was for land within the first 50 yards Rs. 1-8 a *bigha*; from 50 to 100 yards I put on Re. 1, and beyond that 8 annas a *bigha*, so that I reckon on Rs. 32 for a Rs. 500-well.

32. *Q.* Why do you take such a difference in the rates?—Because the water in running along—there are no masonry channels—sinks so much into the soil. You can irrigate much more in the first 50 yards with a pair of bullocks than further away. They have to do the irrigation themselves, and a pair of bullocks comes to 4 annas a

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day. In the first zone 2½ pairs are required=10 annas. In the second tract 4 pairs are wanted=Re. 1. The third will take 6½ pairs which will cost Rs. 1-10 per *bigha*.

33. *Q*. One well will do 40 *bighas* in a year?—Yes, two waterings to the *rabi* crop.

34. *Q*. Do you get anything else besides?—I do not count sugarcane, opium, and formerly indigo. They generally sow on the natural moisture, but they give two waterings in 60 days. A *bigha* is ⅝ of an acre.

35. *Q*. You think well-making actually pays?—It should give a little over 5 per cent. interest. I have done this as Manager of Court of Wards Estates and as a private zamindar.

36. *Q*. But if they were managed by zamindars themselves would there be much difficulty in keeping this arrangement on?—Very few zamindars make wells themselves.

37. *Q*. Different holdings are served by one of these wells?—Yes.

38. *Q*. And they pay the rent to the owner of the well?—No; it is not the custom to take money for water.

39. *Q*. But you charge the rates?—We do, but for private individuals it is not the custom to pay for water.

40. *Q*. (*Mr. Roberts.*)—The Court of Wards is practically the only improving landlord. The other wells are made by tenants and with the tenants the custom is not to charge other men. They get paid indirectly by help in making the well?—The holder of the well supplies the bricks and he gives the men who work for him food.

41. *Q*. (*Mr. Muir-Mackenzie.*)—Have you any difficulty in ascertaining where to make your well?—Yes. We find that preliminary borings are an immense benefit.

42. *Q*. But the difficulty has not been such as to prevent you making a very considerable number of wells?—No. But I have seen so many instances where men have failed from striking on sand. I have known four or five cases in the last two years in which men have gone to heavy expense and struck on sand and got nothing.

43. *Q*. How much would your boring instruments cost?—About Rs. 250.

44. *Q*. We heard Rs. 400 or Rs 500?—Not so much as that. I got over 90 feet of piping from the Agricultural Department.

45. *Q*. Supposing a man of experience were employed by [illegible]ment to endeavour to make wells in other parts of th[illegible], not on Court of Wards estates, could it be ma[illegible]qually cheaply and efficiently? There would be the [illegible] difference that you would be making them on other [illegible]ndars' estates?—Yes. I should go on the lines of ge[illegible]g help from the zamindars round about.

46. [illegible]. You could induce them to give that help?—I think s[illegible].

47. *Q*. Do the people come to you readily for advances for well construction?—The first estate I spoke of is pretty well filled up with wells, and there is not the occasion. Formerly we were making 25 a year. The tenants are making on the average 8 or 10 a year on that one estate now.

48. *Q*. With the help of advances?—A well will cost them about Rs. 250. It would cost me Rs. 500. They will get perhaps Rs. 100 from me, and the rest they will borrow locally. But in these embarrassed estates they simply worry me for wells whenever I show my face.

49. *Q*. Why do they worry you? The Collectors say that they do not worry them?—There is so much trouble in getting money from the Government. Mr. Dampier asked me this year to arrange with my tenants in those estates which could not afford to lend *takavi* to send them on to him with a recommendation that they were good tenants, paying their rents, and he would give it. But we have now a new Deputy Collector and I do not know whether he will do it.

50. *Q*. (*Mr. Roberts.*)—What security do you get? You give on your personal knowledge of the tenants, I suppose?—Yes.

51. *Q*. (*Mr. Muir-Mackenzie.*)—Mr. Dampier appeared to take your personal assurance for security?—Because I know the men.

52. *Q*. (*Mr. Roberts.*)—Practically there is no other security besides land. No tahsildar would take personal security. You say the tenants worry you for advances. That is on Court of Wards estates?—Yes.

(*Mr. Roberts.*)—But the Court of Wards will not unduly enhance their rent. That is their security. They have not the same assurance with a private zamindar.

53. *Q*. (*Mr. Muir-Mackenzie.*)—If the tenant makes his own well, can the zamindar raise his rent on that account?—No. But he can eject him after seven years and harass him about the compensation.

(*Mr. Roberts.*)—The protection is not sufficient to enable the tenant to make it in spite of his landlord. The law protects him, but not enough.

(*Mr. Muir-Mackenzie.*)—Is it not possible to get a law passed to give sufficient protection?

(*Mr. Roberts.*)—They will not try more laws until they see how the North-West Provinces law works.

(*Mr. Muir-Mackenzie.*)—But Oudh has never been so favourably situated as the North-West Provinces.

(*Mr. Roberts.*)—The law was amended in 1886, giving the seven years rule and the rule against enhancement of rent. Previously there was no protection. And now they can claim compensation for improvements.

(*Witness.*)—We had an instance of that in Baiti in Pertabgarh; for 32 wells sunk a landlord raised the rent Rs. 7,000 a year on the strength of them.

54. *Q*. (*Mr. Rajaratna Mudaliar.*)—What profit do you make on your irrigation after all outlay?—The machinery was purchased in 1878-79. It must have paid over and over again.

55. *Q*. The tenants on the estates under your charge are occupancy tenants, I suppose?—No; tenant under the seven years' law.

56. *Q*. So there is no inducement for them to make wells at their own cost?—On the other hand, they have every inducement, because if they are turned out they have to be paid compensation.

57. *Q*. (*Mr. Muir-Mackenzie.*)—I do not understand whether in your wells it is essential to get right down to the *mota*?—All I look for is to get the well on a fairly sound foundation and strike spring water. The natives used the *rambans*, a pole, 30 feet long, shod with iron and weighted. A rope is fastened to the top and they lift this up over a pulley, and half-a-dozen men drive it down. They can get down about 25 feet that way.

58. *Q*. They get to the spring to the *mota*, pierce through the clay bed into the sand below, and the water comes up through that; and your cylinder only goes down to the *mota*?—That is all.

WITNESS NO. 9.—MR. W. A. W. LAST, C.S., Deputy Commissioner of Rai Bareli.

Mr. W. A. W. Last.

22nd Nov. 02.

In reply to questions stated:—

I did the settlement of the Shahjahanpur district from 1896—1900. In that district there was only local distress in the 1897 famine in the clay country (about 15 per cent. of the district) and the *bhur* about 7 per cent. in the north along the Goomtee). Not having been in the executive then, I cannot say much about the relief measures adopted, but they were not on a large scale. There was considerable mortality in the *bhur* country in the north.

Irrigation in Shahjahanpur is partly from shallow *jhils*, partly (in the clay country) from bunded up nullahs but most of all from *kachcha* wells. There are very few *pakka* wells. The *kachcha* ones are cheap and easily made, water level being about 12—15 feet below surface, and serve all the requirements of ordinary years. The people seem satisfied with them and do not seem to care much about making *pakka* wells. There are only, I think, about 600 in the district, *i.e.*, about 1 to 3 square miles. It is a great contrast to Rae Bareli, which is studded all over with fine *pakka* wells. I think explanation of the fewness of the *pakka* wells in Shahjahanpur is to a great extent to be found in the comparative poverty of the cultivating tenants. It is a district of small landlords and poor tenants.

I know practically nothing about the Sardah inundation canal scheme, but I should doubt its capacity for filling the *jhils* and should think it liable to do a good deal of harm. The Shahjahanpur district certainly does not want it.

No district can be called immune from famine, but Shahjahanpur is less sensitive than most to eccentricities of

Mr. W. A. W. Last.

22nd Nov. 02.

rainfall, excepting the unprotected clay and the *bhur* country (about 17 per cent.) which are very sensitive. Setting this part aside, the district may be regarded as protected by its *kachcha* wells from anything but severe drought; but it has no protection against a drought severe enough to make the *kachcha* wells dry up, as they did in Muttra in 1897. I have never known or heard of that point being reached. It may have been reached in 1877. In that famine Shahjahanpur lost more people than any district except Muttra.

If I were asked how to make the district more immune from famine, I should say—

(*a*) In the clay country, develope and improve the existent nullah irrigation and deepen *tals*.

(*b*) Elsewhere encourage *pakka* wells, especially where *kachcha* wells are difficult.

In time of actual famine I should give liberal *takavi* for *kachcha* wells, but this belongs to the policy of cure and not of prevention. *Kachcha* wells are made every year in a few days. They irrigate about 5 or 6 acres, but their capacity varies with the soil—more on clay and less on *bhur*. From what I saw in 1897 I think that in a drought the people would make as many as they could possibly get money and labour for.

Mr. F. F. Bion.

22nd Nov. 02.

WITNESS No. 10.—MR. F. F. BION, Executive Engineer, Lower Division of the Eastern Jumna Canal.

Note on the distribution of water in the Lower Division, Eastern Jumna Canal.

1. The distribution between the different channels is controlled by the Executive Engineer himself, who issues orders weekly as to which channels are to be closed and which opened. These closures depend on the state of demand on any particular distributary and the state of supply available at the time. The period of running of channels generally varies from two weeks in three in times of plentiful supply to one week in four when supply is short.

2. The share of each village on any channel is determined by the area commanded by that channel. The boundaries of the area commanded (generally a drainage depression on a road) are marked on the 16″ village map and the area inside the boundary obtained. This area decides the size of the outlet or outlets to be granted. The first claim is given to fields assessed as irrigated from canal: if, after supplying these, water is available, the claims of fields classed as dry are considered. Fields commanded by wells are not included when fixing outlets.

3. In the case of a *new* channel provision is made when it is designed for a supply sufficient for the area of both canal-irrigated and dry lands commanded by the channel. The percentage of fields left fallow in the neighbourhood is obtained and applied to the total area commanded, and provision is then made for irrigating the area thus obtained.

4. To determine the share of each cultivator the procedure is as follows:—

The tract irrigable from the outlet on which the dispute exists is marked on the 16″ map. Lists are then prepared, showing the number, area, and ownership of each field in the tract. If the holdings are small, two or more owners agree to form a *thok*. The total area on the outlet is then divided by the number of *pahars* (three hour periods) in a week, and the area irrigable in three hours is thus obtained. Taking this as the factor, the time for each *thok* or each owner, as the case may be, is found. The week is then divided up accordingly, each *thok* or cultivator being allotted his particular day or days or fraction of a day.

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1. *Q.* (*The President.*)—How long have you been there?—I have been in the division since March 1900; in charge of the division only since June 1902.

✓2. *Q.* Your charge is the Meerut District part?—Meerut and Muzaffarnagar.

✓3. *Q.* There was in the old days a great outcry against the mischief done by the canal in creating a *reh* surface all over the place, Bhainswal, is that all right now?—Bhainswal is very much better now. We have large drains. They say the *reh* ground is improved.

4. *Q.* Do you remember what the spring level is there?—Eight to ten feet, I think.

5. *Q.* You have taken a great deal of pains in the distribution of the water in the village channels?—We have done a lot of distribution in the water-courses in dividing the shares amongst different village; *oosabundi* we call it.

6. *Q.* Have you effected much economy of water?—Certainly.

7. *Q.* You are getting larger areas of cultivation for the same supply of water?—Yes, the *rabi* figures of 1896-97; we had a rainfall of 0·46 inch, and we irrigated 116,000 acres with a revenue of Rs. 2,96,000, and we lost through failure of supply 928 acres. Last year the *rabi* rainfall was only 0·24 inch. We irrigated an area of 131,000 acres, and the revenue was Rs. 3,40,000, and we had *tokmsokht* 265 acres. For the *kharif* in 1898-99, which was our maximum up to then, the revenue was Rs 4,17,000. Last year it was Rs. 4,35,000 The depth of water in 1898-99 was 2·7 feet over the whole division, calculated on the amount entering the division. Last year it was 2·2. We had a larger area *tokmsokht* due to the Jumna floods, not to the failure of supply. All the *kharif* which had taken water in June was hooded, and I had to remit all that.

8. *Q.* (*Sir Thomas Higham.*)—You take the discharge entering the head?—Yes, for the *rabi* we had a depth of 2 feet in 1896-97, 2 feet in 1898-99, and 1·4 last year.

9. *Q.* (*The President.*)—Is that irrigation an expansion in the villages previously irrigated or entirely new irrigation?—Not new. It is improving the tails of the distributaries and giving a better supply In former years in a dry year they were not sure of their supply and were very careful where they irrigated. All the villages at the tails of distributaries have now increased their areas.

10. *Q.* What do they run up to—Rs 50 or 60 per cent. of the whole culturable area of the village?—Far more than that.

✓11. *Q.* Is there no remonstrance about over-irrigation?—I have never heard any Baraut had been of irrigation, and last year the people petitioned t ne water given them again.

✓12. *Q.* Then any fresh project is devoted to ing irrigation. You won't touch another village whi not irrigated till you have done all you can to presen es?—Yes.

✓13. *Q.* How much of the area is under water every year?—The whole. If I add the *kharif* and *rabi* areas in any one village, it is generally 50 per cent. more than the total culturable area of the village. Those who are assessed for the water have the first right to it.

✓14. *Q.* Are you doing any more in the way of drainage?—I have just sent up a project for a 12-mile drain between the Canal and the Hindan.

15. *Q.* (*Sir Thomas Higham.*)—Have you any fixed rule for distribution as regards the percentage of area in the village allowed irrigation?—We don't enforce that rule at all.

16. *Q.* There is a rule that it should not be more than 40 per cent.; two crops of the total culturable area after deducting the well area. In the old villages it is much more than that?—Yes, in the whole of this Division.

17. *Q.* In some villages it is cent. per cent.?—Quite generally over.

18. *Q.* Have you ever tried to reduce it?—Yes, once on the Agra Canal, and they made an awful howl.

19. *Q.* What is the area of sugarcane?—Last year it was 44,700 acres in the whole division. The total *kharif* was 96,000; that includes cane. That has to take water all through the *rabi*. This year I have done a little more than 70,000 total *kharif*, and of that 42,000 is sugarcane.

20. *Q.* Do you find it difficult to give water for the *rabi*?—The hardest time is in May and June. In the *rabi* it is not so difficult.

21. *Q.* What do they pay for cane?—Rs. 6-10-8 an acre.

22. *Q.* Are these new projects all for remodelling?—Remodelments; not extending to unirrigated tracts.

Mr. F. F. Bion.

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23. *Q.* What are you going to do with the extra water you get? If you improve the distribution, you will save a lot of water? Then I suppose we shall do extensions if we have the water to spare, but we are not doing any at present.

24. *Q.* There have been no extensions in the last ten years. The result of your economy has been to increase the percentage of irrigation in each village?—Yes, it has improved the command and it has given us more flow and less lift.

25. *Q.* You have taken areas near the old villages?—Yes.

26. *Q.* In new villages you propose to give them 40 per cent. of their cultivated area, but if you have not done new villages, how does that come in?—That is a standing rule for the whole province. As a matter of fact, we have not extended it here at all.

27. *Q.* There are requests for more extensions?—I have had lots of petitions for extensions.

28. *Q.* You do not propose to take them up?—Not until I have done my remodelments.

29. *Q.* By that time the people will have irrigated large areas in their old villages and will not like you to take the water away?—Afterwards we can always close off the distributary. At present we run one week in three.

30. *Q.* What are your *tatils*, by branches?—I close the different distributaries week about, but if the supply is tight, it may be one week in three or four as last May. In the Kalapur the branches run alternately and the main distributary two weeks in three weeks.

31. *Q.* Have you been reducing the size of outlets?—Yes, and removing a good many superfluous ones. The ventages are based on the areas previously irrigated.

32. *Q.* If you put them on a shorter time, do not they want bigger outlets?—I do not find it so. We put them on shorter time only so far as the distributary is concerned, but we have done away with the *tatil*.

33. *Q.* When had you begun to do away with them?—In 1901.

34. *Q.* More than one village owns a water-course?—Yes.

35. *Q.* Do they fight?—Yes, and we have to settle the disputes, and distribute their shares in the outlets — so many days and hours each.

36. *Q.* How many villages in a water-course?—I have had four.

37. *Q.* (*Mr. Rajaratna Mudaliar.*)—You have no system of application for water, I suppose?—They apply to me for water if they are not getting it; that is all.

38. *Q.* You leave the rayats to irrigate as much land as they please, without requiring any applications to be put in?—Yes.

39. *Q.* Each year the extent varies with the extent of the rainfall?—Yes.

40. *Q.* What is your check against surreptitious irrigation?—We accept the fact that they can take the water when they like.

41. *Q.* Supposing some rayats plead that they have not taken your canal water, that they have raised the crops with the rainfall?—As soon as a field takes water, it is written up in the patrol's book (*shoodha*). The patrol goes round and sees that the field is having water; these books are checked periodically by every one who goes round.

42. *Q.* Are there any cases in which the rayats might plead that they have not taken canal water?—They cannot hide it, because it solidifies the ground. We get our early *kharif* measurement done before the rains break.

43. *Q.* Well lands in the midst of fields irrigated by canal water might take water surreptitiously?—If they do, they pay the canal rate, but they are not included in the *oosrabandi*.

44. *Q.* Would it not be difficult to prove that they took canal water; they might say they irrigated from the wells?—There is very little difficulty; you can always trace the cut through the *bund* if there is any dispute.

45. *Q.* It might be a crab or rat hole?—It is too big.

SIXTEENTH DAY.

Allahabad, 24th November 1902.

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WITNESS No. 11.—MR. S. H. BUTLER, C.I.E., I.C.S.*

Mr. S. H. Butler.

24th Nov. 02.

1. *Q.* (*The President.*)—What posts have you held in this Province, Mr. Butler?—I have settled the Sitapur District and also the Kheri District. I was in charge of the Hardoi Settlement for some months. I have not done any real inspection work in Hardoi. Sitapur and Kheri are the two districts through which the old Sardah project went first.

√2. *Q.* You are, I suppose, pretty familiar with all the arguments *pro* and *con* of the Sardah Canal?—Yes, I am.

√3. *Q.* What is your opinion?—I think it would ruin Sitapur. I understand they won't irrigate Kheri. Kheri and Sitapur are water-logged as it is. The spring level is said to be rising and to have risen very largely since 1871. This is an engineering question that I don't know anything about, but I do know that the whole of the Gumti *terai* has gone out of cultivation since the last settlement.

√4. *Q.* When was that?—In 1869. 1871 was the year of the great Gumti floods; people say that the bed is silting up. It is absolutely essential according to the engineers, I believe that, if you run a canal through Sitapur, you should drain off the existing *jhils*, which are innumerable in the middle of the district, into the Gumti. Mr. King and Colonel Corbet doubted whether the Gumti would take so much water. I am certain it would not; the drainage is inadequate as it is at times of heavy rainfall. In 1871 the floods washed away parts of Azamgarh and did a lot of damage. In 1894 the floods came above the floor level of the Chutter Manzil. Whether these floods have silted up the bed, or whether the silting up has been a slow process, I don't know.

√5. *Q.* It has not been made the subject of scientific investigation?—No.

√6. (*Mr. Roberts.*)—There was a special enquiry in 1894. Mr. Passanah, an engineer, was put on to go about the country and see what could be done. I never saw the result?—People say the river has been bridged in so many places that the floods have been checked, and the bed thereby raised.

√7. *Q.* (*The President.*)—Is it possible that the Sardah water is getting into it? The Gumti rises in swamps not far from the Sardah and possibly the Sardah water is getting into it. (Conversation over map.) The Sardah has completely changed its course. The small stream (the Dahâwar) formerly connecting the Sardah and Gogra has now become the main stream.

√8. *Q.* When you say that introducing irrigation into Sitapur would ruin the country, do you mean that it would increase the water-logging that already exists?—Yes.

√9. *Q.* Would there be any danger if a high level canal was taken through the district?—Yes.

√10. *Q.* Even if water was passed through without giving irrigation?—I think it would be a very dangerous proceeding. You would have to take it right across the natural line of drainage.

√11. *Q.* A proposal has been made of making a very much reduced Sardah Canal to cross the country there and of giving irrigation to Hardoi at the end of the *kharif*? It would not touch Sitapur. I could not give an opinion about Hardoi, except that the drainage is very complicated there

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* *Note by witness.*—This evidence refers only to the conditions of Oudh. This is stated in the evidence, but much of the evidence is stated very generally; and the limits on its application might be overlooked.

Mr. S. H. Butler.

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already; it would be necessary to have a very careful survey.

12. *Q.* Are these districts thoroughly well irrigated?—Yes. In the south of Oudh, as you know, wells are very numerous. In the four south-eastern districts of Partabgarh, Sultanpur, Fyzabad, and Rae Bareli 42,919 *pakka* wells have been made since the last settlement, 9,099 in Partabgarh, 7,461 in Sultanpur, 15,000 in Fyzabad, and 11,359 in Rae Bareli; in fact, there is a *pakka* well for every 30 acres of cultivation. In Unao, Lucknow, and Bara Banki, the three central districts, 18,717 masonry wells have been made since the last settlement.

13. *Q.* (*Mr. Roberts.*)—That is the settlement of 1869?—Yes, the first regular settlement since the annexation. There is about one well for every 60 acres of cultivation in these central districts. In the four districts of Hardoi, Sitapur, Kheri, and Bahraich 7,471 wells have been made since the last settlement, and there is one well for 225 acres of cultivation. I think these figures show that the complaints that landlords don't allow their tenants to make wells are unreasonable.

14. *Q.* (*Mr. Muir-Mackenzie.*)—How many wells have been made by tenants?—I have separate figures only for Partabgarh: out of 9,099 wells 5,986 were made by tenants, and Partabgarh is a district in which there have always been, since the beginning of the Oudh controversies, the most numerous complaints that the landlords don't allow their tenants to make wells. These figures are taken from Mr. Sanders' Settlement Report. Of course landlords do sometimes object to wells being made, and I have myself investigated about 20 or 25 complaints by tenants; most of these were by high caste tenants who were in large arrears of rent; in one or two cases I thought the landlord was behaving arbitrarily; in one case I remember particularly he said the tenant was only making a well as a first step to getting a grove. You know, no doubt, that by a custom of the country wells and groves are married together. Sleeman talks of this custom in his books; it is commonest among Rajputs, but it is also common among other castes. In Northern Oudh, where land is abundant, most people who make a well also get a bit of land for a grove from the landlord and the two are married with regular ceremony. In the south-east of Oudh the grove area is decreasing; the pressure of population is great, and the custom is, I imagine, breaking down, but anybody who can afford to have a grove and well will marry them. A man who digs a well cannot drink any water from it until it is married to a grove; and a man who plants a grove cannot take fruits from the grove until it is married to the well; that prohibition only applies to the person who makes the well or grove, not to other people. The figures show that in South Oudh the grove area is decreasing, while the well area is enormously increasing, which means that the custom is breaking down there.

15. *Q.* In the case of wells made for irrigation that is not necessary?—No; but everyone, who can, marries his well to a grove or a tree. These figures show that the tenants of Oudh are pretty well off.

16. *Q.* Were you in Oudh in 1896-97?—Yes, I was in charge of the Sitapur, Kheri and Hardoi settlements.

17. *Q.* Was there much distress?—Distress was great in Hardoi, but Hardoi had been broken by the wet years from 1890 to 1894; Sitapur had suffered, but it is a rich district; there are big landlords and they helped their tenantry through. Hardoi is a poor district with a great deal of sandy soil which suffers more than any soil in wet years; *bajra* and *moth* are destroyed entirely in very wet years. Hardoi has much sandy soil and it also has much which is water-logged, so that it was broken before the famine and the famine came and finished it up. The settlement which might otherwise have worked all right had to be revised. Hardoi will always feel drought; Sitapur will not, nor will Kheri.

18. *Q.* What are the chief crops?—*Bajra, moth, urd,* and *moong.*

19. *Q.* Would they not flourish in a dry year?—Yes, if they get water in good time, but they are very delicate and in the famine year the rainfall was not timely.

20. *Q.* Would you say that a district where every 30 acres can be protected by a well is protected from famine?—I think it is protected as far as people who have lands are concerned; yes, I think it is protected.

21. *Q.* We cannot of course protect it from high prices?—Exactly.

22. *Q.* (*Mr. Muir-Mackenzie.*)—Then there is employment for labourers?—In the four south-east districts the population is very dense. In ordinary years I should say the people generally employ more labourers than are absolutely necessary for the work; there is a general feeling of kindness at harvest time. But when prices rise and the people are afraid of scarcity, they are naturally more careful about employing labour.

23. *Q.* (*Mr. Roberts.*)—Wages are paid in kind, not in cash, so the matter of high prices does not touch the labourer, so long as there is work?—In some places they convert wages into cash in a famine year.

24. *Q.* (*The President.*)—Do these wells run dry in a famine year?—Nobody in Sitapur or Kheri has heard of it, and the talukdars say it is unknown; in fact, the water level has been rising. Oudh is intersected by rivers with a perennial supply, the sub-soil is very light and sandy, there must be an enormous amount of percolation. The people say that wells will never run dry unless the Ganges and the Gogra run dry. Oudh generally is fairly well protected against famine, I think; in Hardoi there was a great deal of distress; that is a specially precarious district.

25. *Q.* (*Mr. Muir-Mackenzie.*)—Was 1899-1900 a dry year?—Yes.

26. *Q.* I find from my figures that the area irrigated from tanks and other sources was larger a good deal in 1899-1900 than in 1900-1901 in Oudh generally?—I think the Hardoi figures are less accurate than in any part of Oudh.

27. *Q.* (*The President.*)—Is there anything you think could be done for Hardoi? You bar a canal and you can't have endless wells?—I think we might do a good deal more in wells. But you cannot make wells in a great part of Hardoi; it is pure river sand.

28. *Q.* (*Sir Thomas Higham.*)—Your cultivated area is dependent on tanks?—Yes, and *jhils*; there are no artificial tanks in Hardoi; they made a few in the famine year, but they did not hold water. I would not like to bar a canal in Hardoi, because I don't know enough about it, but I think it would be necessary to be very careful before you did anything in that direction.

29. *Q.* (*Mr. Muir-Mackenzie.*)—The area under wells seems from the figures I have to have gone up enormously, whereas there has been a drop under tanks?—In the famine year the people made tens of thousands of *kachcha* wells in Oudh.* Government gave large advances. In Sitapur the famine year was the best they have had. The light loam was worked very well; they never had such crops before; landlords and tenants rejoiced in high prices and paid off their debts; there was a smaller area cultivated, but the profits were simply enormous.

30. *Q.* (*The President.*)—This *jhil* irrigation is almost entirely *rabi*?—Entirely.

31. *Q.* Does it give a second watering, or do they trust to the Christmas rains?—They trust to the Christmas rains; there are not many *jhils* which give a second watering.

32. *Q.* Would it be an advantage, if by a canal or by the rains of heaven these *jhils* were filled at Christmas time?—It would make assurance doubly sure.

33. *Q.* Supposing a canal could be brought down into Hardoi, without doing injury, to Shahjehanpur, would it be acceptable to the people, or would they think it a nuisance?—They would not like to pay for it; I think they would be afraid of *reh*; tenants are very much afraid of *reh*.

34. *Q.* Is there much *reh* in Oudh?—No; south of the Sitapur District there is a good deal; from there down to Bara Banki there is a little; large *oosar* plains exist south of Unao. There is generally not very much *reh* in Oudh, but the people are afraid of it.

35. *Q.* With your large experience of Oudh, can you suggest anything by which people might be bettered in the way of works as a protection against famine?—I don't think anything is required when you can make *kachcha* wells all over the place for a few rupees. In Gonda and Bahraich water is 12 feet below the surface. I don't believe in interfering between landlords and tenants in Oudh. I don't think Government could do anything except give advances when they are wanted and that they do at present. The Court of Wards have stimulated wells, and some of them are not very successful; it depends on the individual manager.

36. *Q.* (*Mr. Roberts.*)—It depends entirely on him?—In the Kapurthala estate in Bahraich some magnificent wells were made, but not used; even in the famine year the people would not use these wells until pressure was brought to bear on them; then they used them a little.

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* *Note subsequently added by witness.*—It was estimated that 550,000 *kachcha* wells were made in 1896-97 in the United Provinces; and that 140,000 of this number were constructed from Government advances.

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37. *Q.* (*Sir Thomas Higham.*)—Why was that?—They said they did not want irrigation for their maize

38. *Q.* (*Mr. Roberts.*)—In Sitapur and Kheri a great quantity of the area is grain rented?—Yes.

39. *Q.* Grain renting is usually supposed to indicate a low state of cultivation?—Yes, it does.

40. *Q.* How does that affect irrigation? If a canal were made, would the tenants be induced to work other lands or spend their money and labour in making their lands productive?—Grain rents are of course a backward system; there is no doubt that no tenants, or very few, will make a well under the grain-rent system.

41. *Q.* What share does the landlord take?—You may say that it comes roughly from one-third to two-fifths.

42. *Q.* One-third to the landlord?—Yes, after making all deductions; it is a very complicated process; I described it in my Settlement Report. It varies from one end of the district to the other; in the north of Kheri the landlord does not get more than $\frac{1}{7}$th or $\frac{1}{6}$th. Where there is no demand for the land the landlord's share is bound to be low.

43. *Q.* But these rents could be converted to cash rents?—I am very much against any attempts to convert from grain to cash; it has been tried several times in Oudh. Sir A. Lyall was very strong on the subject, when the Oudh Rent Law was under revision. I think there are very few people who could do it successfully. I have seen rents converted by a zealous Deputy Commissioner in Sitapur, and the results were not successful; tenants, who howled for cash rents in years when crops were good and prices going up, howled to be sent back to grain directly the famine came, and they were afraid that bad times were coming. There is a big *taluka* in Rae Bareli, where in the famine of 1877-78 the talukdar reconverted from cash to grain at the request of the tenants and has kept to grain ever since. It is a backward system, but it is working itself out.

44. *Q.* The tendency is to increase the cash-rented area?—Yes.

45. *Q.* (*The President.*)—As regards a village having one well to 30 acres of cultivation, how many acres of irrigation would that have in the year?—It depends on the well. In Southern Oudh there are 4, 6, 8, 10, and 12 buckets working; in Northern Oudh you have small wells in which water is drawn by men and not bullocks. The natives say on the average 10 acres can be irrigated by a well. In Partabgarh in the year of settlement they had 15,522 *pakka* wells and 14,570 *kachcha*, and they irrigated from wells in the year 181,728 acres; that works out to $5\frac{1}{3}$ acres; a *kachcha* well works less than a *pakka* well. That is actual irrigation; there would be an equal area protected, because *kharif* would be on one side of the well and *rabi* on the other; that would work out to on $10\frac{2}{3}$ acres per well. There would be infinite variations according to the size of the well, depth of the water, position of the well, length of the run to the field, sub-soil and nature of the crops. I think from 10 to 15 acres per *pakka* well is protected.

46. *Q.* What do you mean by protection of the *kharif*?—There is no protection of the *kharif*; the area under *kharif* one year is under *rabi* the next.

47. Q. (*Mr. Muir-Mackenzie.*)—In a year of drought the *kharif* would fail?—Yes, it might; they could irrigate if they wanted to.

48. *Q.* Would they not work wells in the *kharif*?—To some extent they do where they grow rice and sugarcane in soil which is not naturally suited to rice and sugarcane.

49. Q. (*Sir Thomas Higham.*)—In a break in the rains do they work their wells in the *kharif*?—Yes, if there is any alarm; wells never run dry.

50. *Q.* (*The President.*)—Would you say that the best agricultural policy for Oudh in the future is to freely encourage the multiplication of *pakka* wells?—Certainly. But I don't think you can make wells without limit. Well irrigation in Oudh is supposed to be of very little value without manure; there is comparatively little manure in the northern districts in comparison with the southern; in Southern Oudh they all feed their cattle; there is more human excrement and greater economy.

51. *Q.* The inference is that they must keep up a certain number of cattle?—Yes, but in Sitapur and Northern Oudh they draw water by hand.

52. Q. Would they irrigate as much as 5 acres to a well?—Yes, 5 to $7\frac{1}{2}$ acres or even more for any one crop is a pretty general estimate. Mr. Hooper, who is a great authority, worked it out and it came to $7\frac{1}{3}$ acres. These figures are taken from the Settlement Report for Basti. (Conversation on some discrepancies in the figures of the Settlement Reports and the figures provided by the Land Records Department.) All these agricultural statistics are only approximate. The Hardoi statistics are very bad owing to the *patwaris* there being bad.

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53. *Q.* Do the Oudh tenants readily take *takavi* advances?—They don't like them much; they won't take them if they can get money elsewhere.

54. *Q.* Would they sooner pay a higher rate of interest?—I don't think they look at the interest or the commission which is taken by revenue subordinates; they look at the repayment; the difficulty is that the tenants must pay upon a particular date; the same difficulty exists in Europe.

55. *Q.* (*Sir Thomas Higham.*)—The irrigated area in all these districts forms a very small proportion of the total cultivated area?—Yes, but then a great part of the northern districts is *terai*—land where irrigation does harm; the people won't irrigate in the whole of the north of Kheri, and in the whole of the north-east of Sitapur; there is also *terai* about Bahraich and Gonda; and in the *terai* water is so near the surface that the land is cold, and the *rabi* if irrigated would rust.

56. *Q.* They don't use wells in these tracts?—Only on the higher ground for garden cultivation; the water is only 5 to 10 feet below the surface; they lift it with *gharras* and levers.

57. *Q.* Would there be any additional cultivation if you made a canal?—The area which would benefit from a canal is the *bhur* tract along the Gumti; that is undulating country; the sub-soil is white river sand. They make little wells and they lift out water in *gharras*; they irrigate very little, but they do irrigate; a canal would certainly do good there, if it could be worked in such uneven country.

58. *Q.* The spring level would be near the surface?—Ten to twenty feet, except on the Lucknow border. A canal would only protect the area which is now more or less protected by wells and *jhils*.

59. *Q.* There are no wide stretches of uncultivated land?—Absolutely none.

60. *Q.* Hardoi suffered very much from drought in 1896-97; was that due to *jhils* not filling, or was there shortage of rainfall?—General shortness of rainfall and the *jhils* did not fill. A smaller area was sown, because the people were in a bad way; they had been exhausted by the wet years that had preceded; 1890 to 1894 were years of heavy rainfall which had hit the district very hard.

✓61. *Q.* You say, if you took a canal through Sitapur, it would ruin it?—Yes, I think so.

✓62. *Q.* You don't think that about Hardoi?—If you could take a canal through Hardoi without water-logging the centre of the district, it would do good. I am not enough of an Engineer to know if it is possible. You can drain Hardoi into the Ganges.

✓63. *Q.* The difference between Hardoi and Sitapur is that one can be drained and not the other?—Yes.

✓64. *Q.* You would have to drain extensively in Hardoi?—Yes, and the drainage would have to begin in Shahjahanpur.

✓65. *Q.* (*Mr. Muir-Mackenzie.*)—Would not the drainage lower the spring level?—I suppose it would.

✓66. *Q.* (*Sir Thomas Higham.*)—Would an inundation canal benefit Hardoi?—I don't know enough about it; I have never been in a canal district. I don't know whether an inundation canal would do good or harm.

✓67. *Q.* The idea would be to run one during the *kharif* and fill the *jhils* when there is a deficient rainfall?—In these places, if you have a big cut, it scours and you get a ravine, but that is an engineering matter. If it could be done without water-logging the centre of the district, I think it would be a very good thing for Hardoi, but I am not competent to give a decided opinion.

✓68. *Q.* They would not want a canal during the *rabi*?—No.

✓69. *Q.* Provided the *jhils* were filled up?—They could do as it is in ordinary years and trust to the growth of wells.

✓70. *Q.* Beyond Hardoi is there any district in which a canal would be beneficial?—No, I think not. Mr. Hooper says—"the only desire evinced by the people is that a canal should not be brought in. This feeling is strong and it is shared by most people who are acquainted with the province."

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√71. *Q.* You have never known any people express a desire for a canal there?—I have heard individual tenants in dry villages, where they can't make wells, ask for canals, but the mass of the people in Sitapur and Kheri are strongly opposed to them. They are afraid of *reh* and water-logging. I was in those districts for seven years and know them pretty well. Landlords are opposed to them with very few exceptions, because they honestly believe that they would be dangerous, and of course they don't want to have canal subordinates coming in between themselves and the tenantry. The feeling on that point is very strong and always has been in Oudh. They say it would upset the social system; but the other feeling is also strong that a canal would produce water-logging.

√72. *Q.* That feeling was very strong when the canals were first proposed in 1870?—Yes.

√73. *Q.* Has it been modified at all as the result of drought?—I am told that one or two talukdars are in favour of a canal, but there is no doubt that the majority are against it.

74. *Q.* If a canal was made, would it be possible to obtain anything out of the landlords in the form of an owner's rate?—All things are possible, but all things are not expedient. They would protest and the Oudh talukdars have protested very strongly at times; it would be a political question.

75. *Q.* I was looking at it simply from an economic point of view; would their rent be increased to an extent sufficient to justify the imposition of the rate?—I cannot see how rents can be increased much in the south of Oudh; they average between Rs. 6 and Rs. 7 an acre over whole districts. In a tract on the border of Sitapur and Bara Banki they average Rs. 8, 9, and 10 an acre for the whole village.

76. *Q.* (*Mr. Muir-Mackenzie.*)—On irrigated land?—No, but the land does not require it; they grow sugarcane without irrigation; it is very fertile soil; perhaps there is something peculiar in the soil.

77. *Q.* (*Sir Thomas Higham.*)—You don't think there would be such a great increase in the productive value of the land as to justify a rate on the owners?—No, and water-rates would be very unpopular.

78. *Q.* Apart from water-rates would it be possible, do you think, to do as we do on other canals where we take something out of the owner?—I think not.

79. *Q.* A water-rate would have to be levied if we made a canal; would the people take the water?—Water-rates would be unpopular in Oudh, because they are quite contrary to the custom of the country; there are no wet and dry rates; the rent is a lump rent; a man may have one anna on the rupee as legal enhancement; it is put on all land equally. People would regard it as *zulum* to assess them specially for water; one or two talukdars have tried to put on a rate for tank irrigation, and the tenants have immediately complained.

80. *Q.* If you made a canal and brought water to the land in a season of drought, would not the tenants be glad to pay?—They would pay of course in years of drought, but a water-rate would be unpopular in ordinary years.

81. *Q.* The question is whether they would take water if they had to pay?—No; not if they could get water from wells.

82. *Q.* We could not make them pay unless they took water?—They would say—you have drained our *jhils* and should give us the water free.

√83. *Q.* A canal would save the expense of lifting?—Yes, but it takes a long time for them to change their customs; if they could get water anywhere else, I am perfectly certain that the vast majority would not touch canal water, because of these rumours that canal water chills the land and produces *reh.*

84. *Q.* (*Mr. Muir-Mackenzie.*)—You wish that a stimulus should be given to the digging of wells?—I don't wish much stimulus given, because I don't think it is very wise; they are working up gradually. In the old days in the Court of Wards a Deputy Commissioner sometimes stimulated the digging of wells with rather ridiculous results in some cases. We can take borings, but the borings are not very well done, and the natives prefer their own methods of finding out whether there is water; they have one method in Kheri which I have seen work very well; little saucers of water are placed on the ground; if they are found to be filled with water in the morning, they say there is water underneath; if they are dry, then they believe there is no water. In the Court of Wards Manager's bungalow at Lakhimpur they had a man who took a boring for a well; after spending some hundreds of rupees on it he got to sand and the thing was useless. The gardener tried the method I spoke of and not 20 yards away found a spring, and a *kachcha* well which cost a few rupees has watered the whole compound ever since. Some old *Kurmis* are supposed to be able to say from taking up a handful of earth whether there is water underneath.

85. *Q.* Mr. Hill, Manager of the Court of Wards, seems to have been very successful?—It is a matter of individuals. In Cawnpore and Moradabad Government tried after the famine of 1877 to start wells and put on selected officers, but zamindars would not take them over when made. Government spent Rs. 25,000.

(*Mr. Roberts.*)—We don't, I think, get full information of failures in the Court of Wards estates.

86. *Q.* (*Mr. Muir-Mackenzie.*) If you have a special man, could the thing be done?—I think "facilities" should be given, but I am against "stimulus."

87. *Q.* By stimulus I was really alluding to such things as the liberal provisions of advances?—I entirely agree that advances should be given.

88. *Q.* That the people, instead of being left to themselves, should be pushed and should have the advisability of taking these advances pressed upon them?—There the personal equation comes in; it depends on who pushes them; if you told the tahsildar to push them, he would say "*jo hukm.*"

89. *Q.* Do you mean that the tahsildar would be likely to stimulate people who didn't want the money to make wells?—Yes.

90. *Q.* And to make wells where they were not really required?—Yes, in the famine *takavi* was given; it had to be given very rapidly, and there is no doubt that a lot of the wells made have not since held water; also in the old days of Oudh some of the Deputy Commissioners used to stimulate well construction, and you see many of the wells are now without any water in them.

91. *Q.* Were they made from advances?—Yes, many of them were.

92. *Q.* If places for wells were ascertained by means of a boring beforehand or in any other way, so that mistakes might be avoided, do you think it would be unsafe to push the matter?—If risks could be avoided, certainly not.

93. *Q.* Would you not go further and, with the object of extending wells, take a certain amount of risk?—Not in Oudh.

94. *Q.* Your remarks are restricted to the particular conditions of Oudh?—Yes, almost all my service has been there.

95. *Q.* You said a great deal of money was spent in the famine on *kachcha* wells?—Yes.

96. *Q.* Was that principally out of advances?—Yes, advances from Government and landlords.

97. *Q.* Principally from Government advances?—Yes.

98. *Q.* Did money-lenders refuse to come forward?—I don't think they could have been said to refuse to come forward; they gave a lot of money, but it was an exceptional occasion and a great deal more money than usual was required. I should say, speaking roughly, that the additional amount was mostly provided by Government on that occasion.

99. *Q.* You don't remember how much it was?—I am afraid not.

100. *Q.* (*Mr. Roberts.*)—What does a *kachcha* well cost?—It varies from Re. 1 to Rs. 6 in Sitapur; in the south of Oudh it is from Rs. 5 to Rs. 30.

101. *Q.* Relatively to the total cost of cultivation a *kachcha* well is only a small proportion?—Yes.

102. *Q.* So that the cost is often met by the people themselves?—Yes, the people made thousands of wells themselves on their own initiative and thousands more were made by Government assistance.

103. *Q.* (*Mr. Muir-Mackenzie.*)—In the famine were there *kachcha* wells mostly made out of Government assistance?—I think the people themselves made more than Government made for them.

104. *Q.* Was a very considerable proportion made out of Government advances and which could not have been made but for them?—A very considerable proportion was made out of advances, and I suppose could not have been made without them.

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105. *Q.* What was the procedure adopted in making these advances?—The ordinary procedure was too slow, and so the Pargana Officers were sent out; they obtained lists of people requiring *takavi* for wells from *kanungos* and tahsildars and landowners and shovelled out the money as fast as possible.

106. *Q.* Did they take money with them?—Yes.

107. *Q.* Do you think it would not be a good thing to adopt that procedure in ordinary times?—You would lose a lot of money unless you had careful enquiries. The dishonest people, if they thought they could get the money direct from the Sahib on the spot, would not make all the wells they had taken advances for. You have to look at the register to see whether the land is actually owned by the man or if it is mortgaged; you cannot do that in the village.

108. *Q.* A great many officers have been in favour of this procedure on the ground that it is precisely in the village that these particulars can be promptly and accurately ascertained?—You could do it when it is exceptional, but if it became the rule, it would be very difficult.

109. *Q.* There was an officer in Bengal who was rather successful and he went entirely on these lines?—It depends so much on the person. I should like certainly any simplification of procedure that can be made without undue risk.

110. *Q.* Do you think the Government will fail to recover a large proportion of these famine advances apart from what they have decided to remit?—I think they have recovered all.

111. *Q.* That would show there has been no particular risk run in spite of everything?—They have wiped out a good deal.

112. *Q.* The Government decided from the first, I suppose, to remit a good deal?—Yes, but you know how these thing are done; perhaps Rs. 10,000 or Rs. 20,000 cannot be traced and that all comes in under remissions.

(*Mr. Roberts.*)—Remissions were not made till some time after the famine was over.

113. *Q.* (*Mr. Muir-Mackenzie.*)—Do you think the provision as regards exemption from enhancement stands in any need of revision?—In view of the figures of well construction in Oudh, I can hardly advance anything in favour of a permanent exemption for improvements. I cannot see that it is necessary in order to get improvements but I think it is very desirable as a part of our settlement policy.

114. *Q.* Why is it desirable?—Because I think that all round in the North-Western Provinces and Oudh we are taking at each successive settlement a smaller and smaller percentage of the actual assets. If you are doing that and at the same time you can encourage improvements, it is a very good thing. Also I think that most Settlement Officers will agree that, so far as there is a defect in our settlement system, it is that a man who works up his village at the end of the settlement is liable to find that his revenue will be enhanced more than that of the person who has left it alone. We guard against that as much as possible; but, as a matter of fact, you cannot make allowances for all improvements.

115. *Q.* (*Mr. Roberts.*)—Is it logically and equitably necessary that it should be so? (Illustrated by an example in which a landlord's rent is Rs. 100; he makes an improvement and raises the rent to Rs. 50 more; the question was asked why the whole improvement should go to the landlord)—Nobody can say that the present rules are not liberal and equitable, and, in view of the figures of well construction, it would be, as far as well protection is concerned, unnecessary to make them more liberal than they are in these districts; at the same time I think the more liberal you are at the settlement the better. There is no doubt that the improvement allowances given at the settlement were not as great as Government intended them to be. Settlement reports show that Settlement Officers did not allow for improvements in the earlier settlements of Oudh to the extent which later we did allow. In the Lucknow report there is a passage "Landlords merely regard the sinking of wells as a ground for enhancement of revenue at the next settlement. Such considerations have materially interfered with the construction of wells." That may be the case in Lucknow, but I don't think it is the case generally. As the figures show an enormous number of wells have been made, and there is not the slightest doubt that the landlords did not know anything at all about the improvement allowances that were notified in the Board's circular. When I went to Sitapur I heard a report at the beginning that a landlord was covering over his wells in view of settlement proceedings. I issued a notice to them to file their claims to allowances for improvements and then they came in thousands. A great many allowances were made on appeal by the Settlement Commissioner.

116. *Q.* (*Mr. Muir-Mackenzie.*)—Do you think they understand that allowances have been made and will in future be made to them?—I think so; but you cannot answer for 30 years hence.

117. *Q.* What happened in the settlement altogether, was there an enhancement or reduction?—There was a large enhancement.

118. *Q.* You don't think the effect of that general enhancement has obscured the fact that they had some improvement allowances?—No, because they got so many allowances on appeal.

119. *Q.* We heard in the Central Provinces that the zamindars said "you say I have had an allowance made for my improvements still I find an enhancement; it seems that is not the case" Is there not a tendency to say that?—There is a tendency to say it, but I don't think they believe it.

120. *Q.* (*Mr. Muir-Mackenzie.*)—You say there is no distinction between dry and wet rate in Oudh?—In all the settlement reports there are no distinctions. In local areas you can sometimes find something like them. For instance, the rents in a tract where wells cannot be made would be lower than where wells can be made, other things being equal.

121. *Q.* The tenant in Oudh has no enhancement of rent ever placed upon him in respect of his improvement?—I should not say "ever," but the rule—certainly in every district I know and I believe in every district—is to take the enhancement of rent on all the tenants at one time and at the same rate. If the landlord wants to get anything out of his tenant for a well or improvement, he will have a *nuzzur* then and there, if he thinks the tenant can pay it. That is their way.

122. *Q.* Can any steps be taken to prevent the landlord getting that *nuzzur* out of the tenant—any practical steps?—No. Any time the Government has attempted anything of that kind it is passed on to the tenant. You cannot stop it. A great many landlords do not do it. I think the majority of the landlords of Oudh treat their tenantry, as a rule, very well, as well as any landlords in the world, but you cannot stop the men who do it.

123. *Q.* You do not think it a feasible measure that may eventually stop it to declare it illegal?—No; it would be futile and inadvisable.

124. *Q.* Can a man sue for it?—No.

125. *Q.* In order to enable advances to be made to tenants for wells, would it be advisable that they should be given any transferable interest in their land merely for that purpose?—You cannot in Oudh, because of the *sanads.* We say we maintain the status at annexation. Lord Lawrence tried to introduce tenant right into Oudh and failed.

126. *Q.* I am alluding to, I think, Mr. Molony's proposal, which is that merely for purposes of *takavi* advances; he proposes to legislate to give the tenant a transferable interest if his landlord refuses to make the improvement?—I do not think you can create any new rights in Oudh without a great deal of trouble, and I do not think they are required.

127. *Q.* Then what security will you get from the tenants?—They have the security of groves, bullocks, carts,—personal property.

128. *Q.* Will that security be sufficient for one owner?—They generally have collateral security too. It is no difficulty to get it from a good tenant. Many of the improvements are made by *Kurmis* who co-operate very much amongst themselves.

129. *Q.* Do several people ever combine to take advances for wells?—Yes.

130. *Q.* Can you give me any opinion as to any measures it might be advisable to adopt for getting into the famine programme works more useful for irrigation?—I cannot give you any general opinion about that. I have served in districts where we do not want works for irrigation.

131. *Q.* (*Mr. Rajaratna Mudaliar.*)—Was the large increase in the number of wells since the last settlement due in some measure to a series of unfavourable seasons, or was there any special cause?—The large resort to well-making was chiefly the result of peace and prosperity which followed the introduction of British rule in Oudh. At the last settlement it was noticed that the tenants had begun at once to make wells, and now they are going on steadily.

132. *Q.* (*Mr. Muir-Mackenzie.*)—They did not stop before the revision of settlement?—I do not suppose they

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made so many, but they did not stop actually. The movement slowed down, no doubt; but it is going ahead again fast now, I am told.

133. *Q.* (*Mr Rajaratna Madaliar.*)—Do you think the extension of wells would have been still further stimulated if more liberal terms had been granted in the way of exemption?—That is rather hypothetical; in a few cases, no doubt, people would have made wells, who have not made them; but in face of these figures I do not think you can say that more liberal exemption in Oudh would have led to a much larger well construction. I am in ~~fave~~ favour of liberal exemption of improvements, but I cannot, in the face of these figures, allege that the present rules have deterred improvements.

(*Mr. Rajaratna Mudaliar.*)—In the Madras Presidency there is permanent exemption and the result is marvellous.

(*The President.*)—Have you anything in Madras to compare with this?

(*Mr. Rajaratna Mudaliar.*)—Yes.

(*Mr. Muir-Mackenzie.*)—In Coimbatore they have some wonderful wells.

(*The President.*)—I have not seen a record of 1 *pakka* well to 30 acres of cultivation.

(*Mr. Rajaratna Mudaliar.*)—We have two or three waterings every week in Madras.

(*The President.*) Is there any place in Madras with a *pakka* well to every 30 acres?

(*Mr. Rajaratna Mudaliar.*)—In Hardoi there has been a decrease of population; was it due to the famine? Mr. Burn, the Census Commissioner, is here, and will tell you about that. I should say the wet years before the famine had a great deal to do with it.

134. *Q.* If the area irrigated from a well amounts to 26 per cent. of the cultivated area, and you say the wells do not give out during a drought, why should the population suffer such a great loss as 20,000 in ten years?—The district had had four years of flooding, which ruined the people, and then on the top of that it had a very bad famine. It has a dry tract as well as a wet tract—one sand and one clay.

135. *Q.* Will not the people irrigate the *kharif* even in a dry year?—They do when they want it; if it is a great drought, they irrigate their crops, especially rice in the *kharif.*

136. *Q.* Could 50 per cent. of the area be protected by well where *kachcha* wells can be made?—Yes, but they do not irrigate a large area—2 to 3 acres in Hardoi.

137. *Q.* Is there a large area of rice under wells?—No, on the Nepal border there are large rice tracts; and the rice is commonly grown in tracts near rivers and in depressions near *jhils.*

138. *Q.* In your settlements did you grant exemptions where the improvements were not registered beforehand?—Yes. There were no registrations in Sitapur and Kheri, and I gave very large allowances indeed. The people did not know of the order to register.

139. *Q.* What was the amount of abatement given in Sitapur?—Over a lakh. It is largely a grain-rented tract, and in a grain-rented district the landlord does everything. Since last settlement at Sitapur they have made an enormous number of new hamlets and brought land under cultivation. For all these I made very liberal allowances,—so liberal in fact that I could hardly justify them except for the enhancement I took, which was 30 per cent. Government wanted a moderate settlement in Sitapur as elsewhere, and they passed my allowances without any objection.

140. *Q.* (*Sir Thomas Higham.*)—A very small proportion of that was on account of wells?—Yes.

141. *Q.* (*Mr. Rajaratna Mudaliar.*)—That assessment was in respect of landlords?—Yes. The estimated enhancement of Sitapur was 60 per cent. That was made on the figures. One had to reject many figures and make allowances for precarious tracts.

142. *Q.* (*Mr. Roberts.*)—Sixty per cent. includes new lands under cultivation?—Yes.

143. *Q.* What allowance was given for improvements?—In the whole of Southern Oudh a large portion of the allowance was given on appeal or in revision. Altogether I should say that at least 5 lakhs, and probably as much as 7 lakhs had been allowed for improvements in 11 districts in Oudh. In the twelfth they are, I believe, making very liberal allowances.

144. *Q.* (*Mr. Rajaratna Mudaliar.*)—What was the amount of reduction to tenants?—Tenants do not get allowances at settlement.

(*Mr. Roberts.*)—We do not get into relation with the tenants at settlements.

WITNESS NO. 12.—MR. H. SMITH, Landholder and Special Manager, Court of Wards, Aligarh.

Mr. H. Smith.

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1. *Q.* (*The President.*)—Have you been long in Aligarh?—Since 1871.

2. *Q.* What part were you in?—The north-east portion.

3. *Q.* Are your lands irrigated by the Ganges Canal?—Yes.

4. *Q.* Then you get well irrigation also?—Yes.

5. *Q.* Is that concurrent with the canal irrigation?—Yes. A great deal is not irrigated from canals, especially in the north-east part between the Ganges Canal and the Choyia *nuddee.*

6. *Q.* Were you in that country during the 1896-97 famine?—Yes.

7. *Q.* Was any distress felt there?—Not very great. There has never been any very great distress in Aligarh.

8. *Q.* In 1877-78?—Yes, but nothing much, principally caused by high prices. The district is practically protected by canals and wells.

9. *Q.* Do you find a disinclination on the part of men to apply for *takavi* advances for wells?—There is no great disinclination, but they do not want it.

10. *Q.* Is that because they are so well off that they can make a well out of their own resources?—That is one reason. There is another; the relations between the tenants and zamindars. If a landlord makes a well, the tenant knows that his land will be enhanced proportionally, and so he does not care for it, and the landlord does not make a well on a tenant's holding unless the tenant agrees to give it (the enhancement.)

11. *Q.* Does the tenant never make a well?—Frequently *kachcha* wells; only the *marusi* (occupancy) tenants, but they are not allowed except by permission of the zamindar.

12. *Q.* Is that refused?—Very often.

13. *Q.* What reason does the landlord give?—For one thing he would have to give compensation if he ejected him. It gives him a kind of right in the land, which the landlord objects to.

✓14. *Q.* You have a good deal of *oosar* in your part?—There is a fair amount.

✓15. *Q.* In the 30 years you have been there have you seen an increase or the reverse?—The reverse.

✓16. *Q.* Do you attribute that to drainage?—It is difficult to say, because the particular tract I was thinking of has a great deal of irrigation, and it was the tract upon which the *oosar* committee was very particular about in 1874, and that tract is now entirely cultivated.

✓17. *Q.* On what side of the Ganges is that?—On the left bank going down to Cawnpore; the east side.

✓18. *Q.* Do you put that down to any special reason?—No, because where drainage cuts have been made, there the decrease has not been so marked.

✓19. *Q.* Have you seen any land that was once covered with *reh* that is now cultivated?—Yes.

20. *Q.* That is very satisfactory.

21. *Q.* (*Mr. Muir-Mackenzie.*)—Have you made wells?—Several.

22. *Q.* How many altogether?—About 25 in the last four years in the Court of Wards.

23. *Q.* What about their success?—Great.

24. *Q.* Do you take an increased rent from the tenants on account of them?—Yes, but only after a certain time we gave them a year or two. The average increase will come to about 10 per cent. on the cost.

25. *Q.* You are able to make them very much cheaper than the Public Works make them?—Very much.

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26. *Q.* Does the tenant contribute his own labour ?—Yes, but they are not very keen in helping, giving their work for nothing.

27. *Q.* Do you give it out on contract ?—Yes.

28. *Q.* What is the nature of the wells—brick ?—*Pakka*.

29. *Q.* How much do your wells cost ?—They average about Rs. 450 to Rs. 500.

30. *Q.* Where do you tap the clay ?—It is 85 feet to the *mota*.

31. *Q.* How many *mots* will that carry ?—Six buckets.

32. *Q.* And the area irrigated ?— About 15 *pakka bighas* per *mot*.

33. *Q.* How many waterings to each field ?—About five.

34. *Q.* I see there are 11,000 masonry wells in the Aligarh district. Are they 6-bucket wells ?—No the average masonry well is a 4-bucket well—perhaps only two.

35. *Q.* This 50 or 60 *bighas* is all, I presume, under *rabi* crops ?—Yes, but they use it for *kharif* as well.

36. *Q.* Is it all manured ?—No, very little of it. The majority of the cultivation under wells is without manure.

37. *Q.* Have you got your tenants to make wells by means of advances ?—One or two. They are not keen on taking advances at all. The tenants have not sufficient money to lay out. The tenants only make *kachcha* wells.

38. *Q.* These 11,000 wells are mostly made by zamindars then ?—I cannot tell.

39. *Q.* How many wells have you on the estates ?—Between 200 and 300.

40. *Q.* Mostly made by the zamindars ?—I cannot tell. They are very old, made by the zaminders, I suppose.

41. *Q.* (*Mr. Roberts.*)—Do you mean the large landlords or the small *patadars* ?—Both.

42. *Q.* (*Mr. Muir-Mackenzie.*)—Have you ever tried to get *takavi* from Government ?—No ; we have generally been able to do it ourselves.

43. *Q.* (*Mr. Roberts.*)—How long does a *kachcha* well last ?—That depends on the stratum of clay it goes to. There may be a great deal of sand.

44. *Q.* But the majority last two or three years ?—Yes, the majority at least three years.

45. *Q.* What does it cost to dig ?—About Rs. 7 or Rs 8.

46. *Q.* Where such a well can be dug it is scarcely best to make a *pakka* well ?—No.

47. *Q.* May that be a reason why more *pakka* wells are not dug ?—Possibly.

48. *Q.* (*Mr. Muir-Mackenzie.*)—Has canal irrigation displaced well irrigation in Aligarh ?—Yes.

49. *Q.* For good or harm do you think ?—Good.

WITNESS NO. 13.—KUAR TARA SINGH, Rais, Jehangirabad.

Kuar Tara Singh.

24th Nov. 02.

(*To the President.*)—There are 2,000 or 3,000 *bighas* irrigated in my zamindari from the canals and many thousands from wells. The canal has taken the place of wells in some parts, and canal irrigation has been of great benefit. (*Reh* has increased a little in low lands, but not in my lands.) The water level in this part of the country is at 20 feet and more from the ground, but near the canal it would be 15 feet. In the famine year the canals were of great benefit, but the supply in the Potal Branch was insufficient. The supply in the Potal Branch is always insufficient. About 30 per cent. or less of the cultivation is irrigated. Where there are both wells and canals, the people do not use wells to supplement canals ; they use the canals only. They make new wells both *kachcha* and *pakka* only where there is no canal. In places where there is a canal, there are very few wells. When the water is short, cultivators arrange for distribution among themselves. There are no complaints about canal irrigation.

(*To Mr. Muir-Mackenzie.*)—Zamindars make both *pakka* and *kachcha* wells ; tenants do not make *pakka* wells but only make *kachcha* wells. The tenants are both occupancy and non-occupancy. When I renew a well, I get an enhancement of rent, not at once, but only when a general enhancement is made. When I make a new well, I claim enhancement, but not immediately ; it is only when the ten years' period comes round. This is the custom. I never have taken *takavi* for well from Government ; I have never asked for it. I often give *takavi* myself to the cultivators. When wells fail and are not renewed, I give abatement of rent to my tenants without application to Government. In other places tenants have to apply to the Collector for abatement. The settlement was made 12 or 14 years ago. The tenants' rents and my *malguzar* were enhanced, and I am not aware that any abatement was given for improvements. I have no objection to my tenants making wells at their own cost ; on the contrary I assist them. There was very little distress in Bashar in 1877-78, because there was a great deal of irrigation. Everywhere now there is a strong desire for irrigation.

WITNESS NO. 14.—RAI MAHABIR PRASAD SINGH Bahadur, Rais, Baraun.

Rai Mahabir Prasad Singh.

24th Nov. 02.

(*To the President.*)—I own an estate of 150 villages in Karchala tahsil and also lands in other tahsils, south of the Jumna, in the Allahabad district. There was a great deal of distress in the famine on the bank of the Ganges and was too low to admit of wells. The water level was 60 to 90 feet deep and then there was very little water. One bucket will water one *biswa* in the day ; in the uplands they water 30 to 40 feet. Wells are made here. There is profit in using water up to 50 feet, but no profit beyond that, except in a famine, when there would be profit in using it up to 75 feet. Irrigation is also done from tanks. There was water in them in the famine which was used for rice and then they dried up. The wells did not fail and never do. Some tenants take *takavi* from Government, but the majority build wells by borrowing money from the *bania*. I have made 30 or 40 wells during the first ten years. The tenants make *kachcha* wells ; I do not. I never refuse permission to a tenant who wants to make a well, but I help him and even give him an advance free of interest. They always ask my leave, however, before building a well. We have established an agricultural society for the extension of wells during the last 12 or 15 years. The Tons carries water throughout February. I do not know if a canal would be beneficial, because I have no experience. There is not much *mar* in my estates ; there is some in 18 or 20 villages only. The soil is chiefly *doumat*. *Mar* soil cannot be irrigated, because it has so many cracks. Embankments are useful in *mar* soil. There are wells in *mar* soil, but not for irrigation. The water supply is near enough, but the soil would take too much water. *Mar* is irrigated from tanks in an ordinary year, but not from wells.

WITNESS NO. 15—MR. R. W. GILLAN, Secretary, Revenue Board, United Provinces, Allahabad.

(*Replies to printed questions.*)

Mr. R. W. Gillan.

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A.—GENERAL.

Question 1.—My answers refer to the Meerut district, which was assessed by me during the years 1896—1900.

Question 2.—I am unable to give the average monthly rainfall. The average rainfall, however, of 30 years is for the three seasons noted below as follows :—

	Inches.
1st June to last November (the monsoon)	25·15
1st November to 28th February (cold weather rains)	2·30
1st March to 31st May . . .	1·51

The monsoon rainfall is characterized by the Meteorological Reporter to Government as light and often uncertain, the east of the district gets more rain than the west, and the south-west corner is most liable to failure of the rains.

Question 3.—Of the total cultivated area 59·78 is irrigable, *i.e.*, is irrigated in the ordinary course and pays a wet rate. The obstacles to an extension of irrigation are—

(*a*) the fact that the best land is already irrigated, and irrigation would be less profitable in the areas which are still dry ;

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(*b*) the great expense or the impossibility of constructing wells in certain tracts where the *mota* is very deep or non-existent;

(*c*) the caution necessary in extending canal irrigation when the supply is often taxed to meet the requirements of the area already watered by the canal in this and other districts.

Question 4.—Land which is irrigated from works constructed by private capital during the currency of one settlement is exempted from enhancement of revenue for the whole period of settlement following; thus the period of its exemption may be anything from 30 to 60 years. This exemption is secured by assessing the land which has become irrigable at dry rates. In this district improvements of this kind have been confined to the construction of wells, and in the case of a new well allowance was made entirely on a consideration of the improvement actually effected, without any regard to the cost incurred. The area watered by each new well was ascertained and a reduction made from the revenue proportionate to that area: if the area was dry before the construction of the well, the full difference between the wet and dry rates was allowed; if it had been previously watered by *kachcha* wells, a smaller deduction was made, varying with the circumstances of the case. A similar exemption has been extended to tenants, but examples of improvements by tenants are rare. In the case of landlords' improvements, I think the existing provisions are sufficiently liberal; at least I am certain that no zamindar has ever been restrained by fear of revenue enhancement, unless, indeed, in the few years immediately preceding a revision of the revenue, from constructing wells. If the case is different with tenants, the reason is that the principles to be observed have not always been clearly understood; not only do tenants undoubtedly fear that their rents will be enhanced, but the impression is very common that even an occupancy tenant cannot construct a well without his landlord's consent.

Question 5.—Loans under the Land Improvement Act are not popular. The reason is certainly not to be found in the rate of interest charged, nor in the period within which repayment is required, and the total remission in case of failure of the attempt to obtain water would relieve the borrower of all responsibility; it would be a case of "heads I win, tails you lose." The reason generally given to me for this unpopularity is the trouble of getting an application through the Government offices, the visits necessary to a far-away tahsil, and the petty exactions of Government subordinates. It is not easy to find a remedy, but if, as I am informed, an enquiry is made and a report required as to the advantages of the well proposed, the area belonging to the applicant which it will irrigate, and so forth, I think the procedure is unnecessary. I would leave it to the landlord or tenant to decide for himself whether the well will pay or not, and I should make sure merely of the repayment of the amount advanced, and of its application to the work proposed. Another reason, however, which certainly militates against the taking out of these loans is the uncertainty of success in well construction. I would remedy this by greatly extending the facilities for making experimental borings.

Question 6.—The irrigable and dry areas are very much intermixed in this district, and I have never heard of any transfer of the agricultural population from one to the other. There can be no doubt of the extreme desire to have irrigation extended to all tracts that are still without water.

B.—Canals of continuous flow.

Question 7.—The reality of an increase due to irrigation in the value of produce is undoubted under all three heads, *i.e.*,—

(*a*) increase of the *dofasli* area;

(*b*) substitution of more for less valuable crops; and

(*c*) increase of yield in years of drought or scanty rainfall.

I have no means, however, of defining the increase under (*a*), for the *dofasli* area was not properly recorded at last settlement, and a comparison of past and present figures would therefore be misleading. As an example of improvement under (*b*) I select Puth and Garhmuktesar, the parganas in which the increase of canal irrigation has been largest, and for which following figures may be given:—

	Garhmuktesar.	*Puth.*
	Acres.	Acres.
Canal irrigation at previous settlement	4,394	1,581
" " at present "	15,257	9,496
Increase of canal irrigation	10,863	7,915
" in area of cane	2,796	1,559
Percentage of increase of cane area compared with total cultivation	6·77	6·57
Decrease in inferior *kharif* crops (*bajra*, etc.)	1,864	3,646
Percentage of decrease on total cultivated area	2·76	1·727

Question 8.—Towards forming an approximate estimate of the increase in the local annual value of the produce per acre due to irrigation, the only point which I can contribute of my own is a comparison of rent rates. I think it is proved for this district that the proportionate value of wet to dry in the same soil is annas 1·6 to 1, and I infer that on the average of a normal term of years the produce of irrigated land is 60 per cent. greater than in unirrigated. The difference is greater in good soil than in poor soil, not proportionately but actually.

Question 9.—The rate actually paid by the cultivator to the Canal Department varies according to the crop irrigated: for 1st class crops (cane and rice) it is Rs. 6-10-8 per acre; for 2nd class (*kachhiana*) Rs. 4; for third class (wheat and most of the *rabi* crops), Rs. 3; 4th class (*kharif* generally), Rs. 2. These are rates for "flow irrigation," the rates for "lift" being one-half those for flow. The average annual rate per acre seems to me to be simply the figure obtained by dividing the total amount of occupiers' rates by the area on which those rates are charged. The figures for the canals that supply the district are:—

			Upper Ganges.	*Eastern Jumna.*
			Rs.	Rs.
1894-95	...	...	4·26	5·30
1895-96	...	...	3·34	4·07
1896-97	...	...	3·19	3·83
1897-98	...	...	3·36	4·09
1898-99	...	...	3·37	4·05

This rate is charged on the area actually irrigated.

(*b*) The rent paid by the cultivator to the owner of the land is, as already stated, 60 per cent. higher than if the land were dry; thus we may take as typical rates Rs. 9-9-7 first class wet, Rs. 6 first class dry, Rs. 7-3-2 wet, Rs. 4-12-9 dry second class. Here, however, the enhanced rate is paid not on the area actually irrigated in each year, but on the irrigable area, *i.e.*, the land commanded by water, which can be irrigated when in the ordinary course the crop or season requires it.

(*c*) The rate paid by the owner to the Canal Department is one-third of the occupier's rate, but this he has to pay only when the land has become irrigable since settlement and is consequently still assessed as dry. This enhancement of revenue may be taken as proportionate to the enhancement of rent.

Question 10.—The only private expenditure necessary to bring the water to the field or prepare the land for irrigation in the case of "flush" irrigation is the digging of the necessary channels, and the preparations of *kiaris* or small plots in the field to retain the water: the cost, which is almost nominal, falls on the cultivator. In the case of "lift" irrigation the labour of raising the water to the level of the field has to be paid for. I reckon it at 5 annas per acre for each watering.

✓*Question* 11.—The subject of deterioration resulting from irrigation is a very wide one. The practice of irrigating without manure is condemned as harmful, but can hardly be said to exist in this district. Too profuse irrigation, which is equally condemned, is much commoner, and is one of the defects usually ascribed to canal as compared with well irrigation. Water-logging and the spread of salt efflorescence have been bitterly complained of, not only in this settlement, but in those of Muzaffarnagar and Bulandshahr as due to the canal. I believe that the canal is partly, if it is not wholly or even chiefly, the cause of these evils.

✓(*a*) In the *khadir* or low lands of the different rivers there has undoubtedly been a great and apparently a permanent deterioration. The *khadir* of the Hindan has not been cultivated for 20 years: the *khadir* of the Ganges, which in 1870 was the richest part of the parganas in which it is situated, is now very inferior. In the upland there has been no actual falling-off in cultivation, but a decrease of fertility due to the spread of *reh* and water-logging is alleged.

✓(*b*) But the settlement was made at the end of a cycle of wet years. The annual rainfall averaged between 1867 and 1875, 25·06 inches; between 1876 and 1885, 29·19 inches; and between 1886 and 1895, 41·69.

(*c*) Extensive deterioration occurred about the same time in districts as far removed from all canal influence as Budaun and Unao.

(*d*) A very few years of drought have very materially improved the deteriorated tracts, as I have personally observed. The crops in the upland tracts which were affected have greatly improved, and even in the *khadir*, though it has not recovered its former excellence, cultivation has revived very rapidly. This would not be the case if the canal were really the ruling factor.

✓(*e*) The canal cannot produce *reh* in soil which does not already contain it; it merely facilitates its appearance. I look upon the *reh* problem, so far as it is connected with canals, as an incident in the water-logging or super-saturation which is ascribed to them.

✓(*f*) A canal can produce this super-saturated condition only by raising the sub-soil water level, and all the facts point to the conclusion that this is affected very much more by the rainfall than by percolation from the canal.

✓(*g*) Since the settlement I have found that this conclusion has been verified by actual experiment (see Colonel Clibborn's report on construction of irrigation wells, 1883, paragraph 45.)

✓(*h*) Not only soil deterioration, but the prevalence of fever and impaired physique in the population have been freely ascribed to the influence of the canal, and I admit that the Settlement Officers of Bulandshahr and Muzaffarnagar to some extent admitted the connection. In view of the facts detailed, however, I fail to see how we can avoid the conclusion that a cycle of wet years has been a more powerful factor than the canal in producing the evil effects noticed.

E.—Wells.

Question 34.—(1) The depth to water in permanent wells varies often very capriciously. I have no doubt that distinctions could be made of tracts in which the general level is higher or lower, but these have not been worked out. I take the average depth to water in this district to be 20 feet.

(2) The supply in the case of *pakka* wells is from springs of *kachcha* wells from percolation. It is difficult to find another word, but "spring" is hardly accurate. The cylinder is sunk till it reaches a clay stratum called the *mota*, which is then pierced, and the water comes through from a sandy stratum below. The function of the *mota*, however, is merely to support the well above the catchment basin which is formed in the sand below. A year of drought affects these wells by lowering the water-level, but cases of failure are certainly very uncommon. The wells were worked with incredible assiduity during the famine years.

(3) The cost of construction for a one-*lao* well 20 feet of water is roughly Rs. 350: for two-*lao* well Rs. 500.

(4) A well may break down if founded on too thin a *mota* or on what is called the *sar* or through some other accident, but a *pakka* well properly built on a good *mota* is practically permanent. A semi-*pakka* type of well found in the district and called *kothiya* consists of a cylinder of wood, above which a cylinder of large bricks (*garand*) is built up without mortar; these last 15 to 20 years. *Kachcha* wells are very uncommon, and do not last more than two years.

(5) The water is always raised by cattle in the manner known as *kili*.

(6 and 7) I have made no experiments as to the area commanded by a well or actually irrigated by it in any one year, but from the enquiries I have made, I should say that a one-*lao* well of the kind described commands an area of 50 *pakka bighas* (31 acres), of which it will irrigate 30 in any one year.

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Questions 35 *and* 36.—My answers to these questions must be the same as to the corresponding questions on canals. The differences with which I am acquainted are—

(*a*) That the produce in well-irrigated land is larger than in canal-irrigated, and that, therefore, the increase in the value of produce due to such irrigation is greater. On the other hand, the net profit to the cultivator is certainly not greater than in canal irrigation.

(*b*) The introduction of well-irrigation does not increase the area of *dofasli* or cane so largely as canal irrigation.

(*c*) It is less liable for that reason to exhaust the soil.

I do not see how the difference could be made the subject of experiment unless the experiments were continued through a very long series of years. As a matter of observation, however, I do not believe that with proper cultivation canal irrigation need impoverish the soil. And if we judge by the test of rent-rates, the advantages and disadvantages of both systems must very nearly balance. We have never been able in any part of the district to work out different rates for canal and well irrigation.

Question 37.—The answer to this question is the same as to the corresponding part of Question 9.

Question 38.—Great difficulty is often experienced in the selection of a site for a well owing to the capriciousness of the *mota*. In a few cases tools for trial borings have been procured from Cawnpore, and they have been greatly valued. It would be a great boon if sufficient tools and men could be supplied to each district to meet the demand.

Question 40.—My answer to this question, whether the construction of wells by Government in land which is private property is advisable, may be influenced by long residence in a district where the people are generally well off, and the necessity for Government action is not very urgent. It appears to me, however, that it would be very much better to devise some means of facilitating advances under the Land Improvement Act than to undertake the actual construction of wells. Some reasons present themselves as obvious:—

(*a*) The wells would be scattered, and supervision very difficult and expensive.

(*b*) The irrigation arrangements in a village of small proprietors or among the tenants in a zamindari village are extremely complicated, and wells constructed without a consideration of those arrangements, which would involve a laborious enquiry, might fail of their purpose.

(*c*) Above all wells constructed by Government would cost a great deal more than wells made by the zamindar. I do not mean merely that work executed by the Public Works Department is always more expensive than work carried out by a private individual. In the case of a well, there is a special circumstance to be borne in mind, and that is that it is regarded as a good work in which the whole village may take a helping hand. The man who undertakes its construction is given a great deal of labour free in the working of his brick-kiln: he gets contribution of *upla* and refuse, and when the cylinder is being sunk, though the men employed in excavation are paid workmen, there are always villagers to help in drawing out the earth excavated who get nothing but their food. In estimating the cost of a two-*lao* well at Rs. 500, I reckoned all this labour as paid for. The actual cost of a well constructed under these circumstances to the zamindar would be perhaps Rs. 400.

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1. *Q.* (*The President.*)—You did the settlement of Meerut?—Yes.

2. *Q.* You say in reply to Question 3 on page 49 that "of the total cultivated area 59·78 is irrigable, *i.e.*, is irrigated in the ordinary course and pays a wet rate?—Yes.

3. *Q.* Do you think it is desirable to have more irrigation than that in the *zillah*?—As much as you could possibly get.

4. *Q.* Do you think you could do it cent. per cent.?—I cannot; the soils are against it. I mean it is physically impossible. There is a lot of sandy soils on high levels which would not be reached by water.

5. *Q.* But you would not mind irrigating every acre that could be reached?—No.

✓6. *Q.* There used to be a strong theory that the health of the country and the spring level would rise, and there would be water-logging if you went beyond one-third or one-fourth of the total area. You don't believe in that at all?—I don't think so at all.

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√7. *Q.* We had some evidence the day before yesterday that the amount of irrigation in the Eastern Jumna Canal in your *zillah* was enormous and that they have effected economies, thereby reducing the size of the outlets; that they are not extending the irrigation to new villages, but are hoping to raise the area in the villages already irrigated. There is very little room for extension I should have thought; those parganas are heavily irrigated. There is some to the east side of Baraut, but in Chaprouli, Kotana, and Baraut the percentage of irrigation is very high and practically all is irrigated that ever can be. (Witness pointed out the places on a map and said that between the rivers Keshni and Karinuddi you need not extend irrigation.)

√ 8. *Q.* Then you do not have apprehensions for the real good of the country from over-irrigation?—No; none at all from irrigation itself.

√9. *Q.* What do you infer from saying "by irrigation itself?"—I think in some particular cases harm has been done by blocking the natural drainage, and so on.

10. *Q.* Do you think, if that is attended to, one need not be anxious about it?—I should not think so.

11. *Q.* You quite admit that the loans under the Land Improvements Act are not popular, and you give the reasons which are generally given, that is, the trouble of getting an application through the Government officers, and so on. Would you advocate having a Deputy Collector or some one of that grade told off for the work alone of advancing loans?—I think it would do a lot of good in particular tracts where it is specially required.

12. *Q.* Would you give him the authority to do it without reference to the Collector? Would you send a man out with a bag of money and say to him "Go and spend this to the best of your ability?"—I don't see why it should not be done by the ordinary staff in the course of the cold weather work.

13. *Q.* The argument is that they are over-worked and that they cannot do it?—I think they could do a good deal in that way.

14. *Q.* I think a good deal depends on the Collector whether he is personally interested in the matter or not?—Yes.

15. *Q.* You say "another reason, however, which certainly militates against the taking out of these loans is the uncertainty of well construction." Did you experience much of that in the Meerut district?—Yes, there is a great deal. I believe it varies very much in different parts of the country. There are some districts where the *mot* is practically continuous, I understand, and others in which it is very patchy.

16. *Q.* They are very capricious?—Yes.

17. *Q.* You go on to say "I would remedy this by greatly extending the facilities for making experimental borings." There is a technical adviser attached to the agricultural department now?—Yes.

18. *Q.* There is only one man, I understand, for the whole of the United Provinces. Do you think it would be a good thing to have somebody of that sort in each district where wells are wanted?—Wherever there was enough work for him.

19. *Q.* Would there be enough work?—In many districts there certainly would be, I think.

20. *Q.* (*Mr. Muir-Mackenzie.*)—In what districts; could you name some?—Meerut for one.

21. *Q.* You already have a tremendous lot of wells there?—Yes, but they are always making more, I believe; all the districts there are much the same; Aligarh, for instance, and all that part of the Doab (indicates on the map.)

22. *Q.* Had you experience of other districts before you went to Meerut?—Not in much detail.

23. *Q.* (*The President.*)—Do you think, considering the great advantages obtained by canal irrigation, that the rates might fairly be raised?—I don't know. I find in Meerut that the rents on well-irrigated and canal-irrigated lands were absolutely equal. If you raise the canal rates, it would affect the rents, I should think.

24. *Q.* Apparently where a man has a choice from the well and the canal, he takes from the canal; does not he?—Yes.

25. *Q.* It is rather curious that the rental is not higher?—In a village that gets canal irrigation it is rather difficult for a man to stick to his well; the whole system of agriculture is changed.

26. *Q.* They are all keen to get canal irrigation?—Yes; all the people who have got wells in the well-irrigated tracts are always crying out for canals.

27. *Q.* (*Mr. Muir-Mackenzie.*)—Mr. Butler surprised me this morning by saying that in a village cram-full of wells; people would not like to have canals.

28. *Q.* (*The President.*)—If the rental is the same for one as the other, the zamindar has not got much interest in the canal irrigation. I suppose it makes his rental more sure?—There are some very good well-irrigated tracts in Meerut. I should think they are just as good as the canals, I do not quite understand it, but I am quite certain that is a fact.

29. *Q.* (*Mr. Roberts.*)—Are the wells there constructed by tenants or landlords?—Nearly all by landlords.

30. *Q.* Large landlords or cultivating landlords?—Cultivating landlords.

31. *Q.* (*Mr. Muir-Mackenzie.*)—You have a great many cultivating landlords?—They are practically all cultivating landlords up there.

32. *Q.* You say in reply to Question 11 (*a*) that "in the *khadir* or low lands of the different rivers there has undoubtedly been a great and apparently a permanent deterioration. The *khadir* of the Hindan has not been cultivated for 20 years; the *khadir* of the Ganges, which in 1870 was the richest part of the parganas in which it is situated, is now very inferior." I am rather puzzled about that. I knew the *khadir* of the Ganges about that time, and I cannot recollect that it was very fertile. I am judging from Mr. Forbes' assessment in Pooth and he said the *khadir* lands were then rated as the best lands.

33. *Q.* (*The President.*)—There could not have been a better man to go by.

34. *Q.* They have all now gone to the bad, you say?—Yes. They have revived very much in the last few years.

35. *Q.* With dry years, I suppose?—Yes.

36. *Q.* You say the *khadir* of the Hindan has been cultivated for 20 years. Was it ever cultivated before?—At the last settlement, yes.

37. *Q.* This is very interesting to me; it shows how slowly it works. It is the canal that is doing this?—I don't suppose the canal is doing it for a moment.

38. *Q.* (*Mr. Roberts.*)—What is the reason for the deterioration?—I think it was simply the excessive rainfall. It was not very marked in any particular year, but I took it in 10 years, and I found that in the last 10 years that preceded settlement, the average was something like 40 inches. The average in the ten years period before that had been, I think, about 25 inches.

39. *Q.* I thought the *khadir* was the least dependent on the actual rainfall of a given year?—Yes, but this saturation has been the cause of the sub-soil water escaping into the *khadir* from the high lands.

40. *Q.* (*Mr. Muir-Mackenzie.*)—You might say the canal would do less injury in a dry year than in a wet one; the canal *plus* rain would do more injury than the canal *minus* rain?—That is quite true, but it seems to respond quickly to a series of wet years and then a series of dry years.

41. *Q.* (*The President.*)—Now the *khadir* of the Hindan had been watered on the east, you may say, since 1855, and on the Eastern Jumna side for 30 years. Previous to that I wonder if it went through changes of getting better and worse in a cycle of years?—It has been better the last few years I know.

√42. *Q.* You say in reply to Question 11(*e*) "the canal cannot produce *reh* in soil which does not already contain it; it merely facilitates its appearance. I look upon the *reh* problem, so far as it is connected with canals, as an incident in the water-logging or super-saturation which is ascribed to them." I suppose you consider drainage the true remedy for the super-saturation of soil?—Yes, but I don't know that it will get rid of the *reh*.

√43. *Q.* We have had some evidence that in other places the *reh* has been got rid of. We had a gentleman to-day, Mr. Smith, from the Aligarh district, who distinctly renumbered *reh* where now there are flourishing crops. After a comparison with Mr. Forbes' settlement have you not recognised any good resulting from drainage?—Certainly. It has been proved in several cases very distinctly.

√44. *Q.* Has that not been in the reduction of *reh*?—No. It is generally much more marked in reducing the super-saturation than in enabling people to sow crops where they could not previously. Mr. Michell in Meerut has made a lot of drains and has greatly benefited his estates in that way.

45. *Q.* (*Sir Thomas Higham.*)—You say that in some cases trial borings have been made. The boring tools have been procured from Cawnpore?—Yes.

46. *Q.* Are they very much appreciated by the zamindars?—They are very much appreciated by the zamindars when they can get them.

47. *Q.* Do they all rely on the results obtained?—I cannot say that; it is only just starting.

48. *Q.* Have you ever heard of cases in which the borers have told them that they will find a good *mot* and then they have put down a well which has not been a success?—No, I have never heard that.

49. *Q.* Do they charge anything?—They charge for the man's time, I think.

50. *Q.* Why do you have to get them from Cawnpore? Is there nothing nearer?—They are not available anywhere else.

51. *Q.* Is there only one set of tools?—There are several sets of tools, and I think the Director has several sets even now.

52. *Q.* Where do you get them from? From the Director?—Yes, you apply to him.

53. *Q.* They do not charge anything for the use of the tools?—No, I do not think so.

54. *Q.* (*The President.*)—I think we heard in evidence that they charge ten rupees.

55. *Q.* (*Sir Thomas Higham.*)—I suppose you have no programme of relief works for your district?—I never heard of it. It was absolutely untouched by the last famine.

56. *Q.* What is the average holding of a zamindar roughly?—I should think about 10 acres.

57. *Q.* He is quite a small man; hardly differs from the rayat in any part of the world. Then I suppose he probably understands very well that he gets an allowance made him as an exemption on a well made by himself?—No, I do not think they know that.

58. *Q.* You do not think they understand that?—No.

59. *Q.* Do not you give them a statement showing your assessment and how much has been taken off as exemption for improvements?—They know it now, but they did not know it before last settlement.

60. *Q.* It made them ease off well building a little before the settlement?—They did.

61. *Q.* Do you think they know it now?—They must know it now, because they know how much each man got off from his well.

62. *Q.* I suppose there was a lump assessment?—About 30 per cent.

63. *Q.* The question of tenants making wells is hardly practical in your district?—No.

64. *Q.* Have you had any settling of tenants' rents there to do?—Yes, a great deal.

65. *Q.* Does a tenant, who has made a well, get his rent at the revision of the settlement levelled up to the prevailing wet rate?—Yes, unless he can show that the irrigation is from a well that he has made.

66. *Q.* If he shows that, his rent is not levelled up?—No. It is not raised to the wet rate. That is a point they all know about.

67. *Q.* Then there are a few cases of tenants' wells?—Yes.

68. *Q.* Would they come and claim the exemption?—Yes.

69. *Q.* That exemption lasts in the case of the tenant, I suppose, for ever?—I am not quite clear on that point. I suppose it does.

70. *Q.* I mean the same thing would happen at the next settlement; I suppose he would again come forward and claim exemption?—Yes, I think so.

71. *Q.* Do landlords exact from the tenant any ***nuzzurana*** or ***salami*** for the consent they give to his making a well?—Generally.

72. *Q.* That of course they could not sue for?—No.

73. *Q.* Nevertheless they get it?—In nearly all cases they get it. Besides the power of the landlord is too great for him to be able to refuse.

74. *Q.* (***Mr. Rajaratna Mudaliar.***)—Is it a very large sum, the *salami*?—I could not tell you that.

75. *Q.* (*Mr. Muir-Mackenzie.*)—What is the period in practice within which repayment of a loan is generally required?—Not outside five years.

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76. *Q.* How soon after the grant of the loan do the instalments of repayment begin? Do they wait a year or two for the well to begin to pay?—It is always after the well is finished. I don't know how long they wait after that.

77. *Q.* You have not had much to do with it?—No.

78. *Q.* Mr. Molony suggested to me that if occupancy tenants are to be encouraged to make wells, it will be necessary to allow them to make their interests saleable; for that purpose he does not mean generally saleable, but that they will have to have some special provision enabling them to be sold up in case they do not pay. Do you think that would be necessary in the case of ***takavi*** loans?—I think it a very good idea.

79. *Q.* If it were not done, would there be great difficulty in getting proper security for the loans; do you think?—It is very difficult to get security from the zamindar.

80. *Q.* But he has always got his lands?—I mean in the case of an occupancy tenant.

81. *Q.* Is it difficult for the occupancy tenant to get collateral security?—I should think so.

82. *Q.* Do you think they would be unlikely to combine? Might not you have several tenants applying jointly for a loan for a well?—I really do not think it is very much practical good. As far as I have seen from the *takavi* of the famine, those loans are not paid up any better than individual loans.

83. *Q.* But famine loans are rather special; are not they?—Yes, they are of course.

84. *Q.* You would only make your loan for *pakka* wells to substantial occupancy tenants?—Yes.

85. *Q.* We have heard of some cases of great big wells of six and eight buckets' dimensions, and they are used apparently by a great many different people. If those people continue to get a loan, their individual responsibility would not necessitate landed security. Do you think that is not practicable?—I think in ordinary circumstances it would be. It is different, as you say, in a famine.

86. *Q.* In the case of the single tenant collateral security would be difficult to get; could you not rely on his personal security? Could you not discover men of good character in the village; do you think?—Undoubtedly, but it is very difficult.

87. *Q.* Do you think you could not do it if you went out on the spot?—But something might happen to such a man, and he might not be able to carry out his part of the contract.

88. *Q.* If the thing is to be encouraged, do not you think Government should like a little risk?—Then it is not a security.

89. *Q.* In the statistics that have been given us as regards wells, there are only two classes of wells, temporary wells and masonry wells. Have you any idea whether temporary wells include these *kathiya* wells?—Yes, they do.

90. *Q.* That is rather misleading and almost wants three classes?—I do not know. The masonry well really is permanent for all purposes and the *kathiya* well is by no means permanent.

91. *Q.* You say in answer to Question 34, clauses 6 and 7, "I should say that a one-*lao* (that is one bucket) well of the kind described commands an area of 50 *pakka bighas* (31 acres) of which it will irrigate 30 in any one year?—Yes.

92. *Q.* That sounds a very high figure. I think Mr. Butler suggested 10 acres as the highest?—I think for one thing it really is higher in those Upper Doab districts. I was looking at a statement the other day in Colonel Clibborn's report and he works out the areas commanded by wells. He does not put it as high as that, but it is considerably higher in Meerut and Muzaffarnagar than it is in the Lower Doab.

93. *Q.* Then, taking the statistics given us, they work out to only five acres?—I suppose you have got the area irrigated in one particular year; I have got the irrigable area.

94. *Q.* You have given us a commanded area of 50 *bighas* and an actually irrigated area of 30 *bighas*?—I have got the irrigable area in this report as 221,589 acres and the number of wells as 3,205 *kachcha* and 10,178 masonry.

95. *Q.* What is the area actually irrigated from the well?—I have not got that for any one year.

96. *Q.* What have you then?—The irrigable area; the area that was classed as wet.

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97. *Q.* How do you estimate the irrigable area ?—It was taken, as a matter of fact, from the entries of three previous years. Any field that had been irrigated in any one of the three years was regarded as irrigable.

98. *Q.* What you mean is that it was the commanded area, not the actually irrigated area ?—It is the area that pays a wet rate.

99. *Q.* The wet rate is taken year in and year out on lands, perhaps irrigated one year in three ?—It is generally irrigated more often than that. It may be two years out of three, but it is not every year. A lot of it is fallow, and then they also grow crops which do not require irrigation.

100. *Q.* Then these figures given to us of 86,000 acres and 17,000 wells you will feel inclined to doubt ?—I do not know why there should be that discrepancy in wells.

101. *Q.* (***Mr. Roberts.***)—This 30 acres you refer to is an estimate ?—Yes ; it is an estimate simply.

102. *Q.* You rely on that estimate very much for your assessment ; do not you ?—Not at all.

103. *Q.* Do not you rely on the irrigable area ?—Yes, entirely. That is not affected by the estimate of 30 acres for a well or anything of that sort. The irrigable area is obtained by noting for each particular number of the *khasra* whether it has been actually irrigated in any one of the three preceding years.

104. *Q.* Then you take the *patwaris' khasras* as very accurate ; you rely upon them considerably ?—Undoubtedly.

105. *Q.* Are they checked at the time of settlement ? Are they more likely to be correct in settlement year than otherwise ?—The settlement *khasra* is. It is very thoroughly checked and the Settlement Officer, as a matter of fact, checks the irrigation on the spot.

106. *Q.* (***Mr. Rajaratna Mudaliar.***)—Can these 30 acres be irrigated at one and the same time by a well ? Can the whole 30 acres be simultaneously got under irrigation ?—What I mean by saying that 30 acres is commanded by a well is that out of that amount there is a certain area that will require water each year and that one well will be sufficient to supply water to the area that requires it. The whole of the 30 acres will not require it every year.

107. *Q.* Supposing water was required every year, how much will a well irrigate ; one-third of the area or the whole area ? In a particular year how much area would be irrigated as a maximum ?—Say two-thirds of that or 20 acres.

108. *Q.* The whole area could be cropped ?—The whole 30 acres would be cropped and 20 acres of it would be irrigated.

109. *Q.* The irrigated crop could not be grown upon the whole 30 acres at the same time ?—No.

110. *Q.* You say 20 acres could be irrigated at the same time ?—I think so in one year.

111. *Q.* Taking the area under *khurif* and *rabi* together ?—Yes.

112. Q. In any particular season, I suppose, 10 or 12 acres alone could be irrigated at one time ?—Yes.

113. *Q.* In a dry year what area could be irrigated, considering the fall in the spring level and other conditions ?—I do not think you would have to reduce it by more than one-third.

114. *Q.* In answer to Question 3 you say—"Of the total cultivated area 59·78 is irrigable, *i.e.*, is irrigated in the ordinary course and pays a wet rate. In the statement prepared from the agricultural statistics published by the Government of India the area irrigated in 1900-01 was only 372,000 acres out of a total culturable area of 1,155,000 and odd. That does not come up to even 30 per cent." How do you get your figures ?—I say it was taken from the *khasras* of the three previous years. For each particular field we know whether it had been irrigated, as a matter of fact, in any one of the three previous years. If it had been irrigated, it was marked "irrigable." Anything that had been irrigated in any one of the three years was marked as "irrigable."

115. *Q.* You do not take the average of the three years ?—No.

116. *Q.* You take the totals of the three years ?—No ; it is not the totals either. For instance, there were many fields that had been irrigated every year ; there were other fields that had been irrigated two years out of three, and there were other fields which had been irrigated in only one year out of three.

117. *Q.* You took neither the average, maximum nor totals ?—It is not a thing you can get by arithmetic out of a total number of years. We simply had to decide with regard to each field whether it had been irrigated. If it had been irrigated it went down as "irrigable" and the irrigable area was the total of such fields.

118. *Q.* Supposing there were three fields measuring 10, 12, and 20 acres, respectively. Each one of these fields might have been irrigated in different years. What do you take then ? Do you take the total of the three ?—Certainly. If a field was irrigated three times, I would calculate the area irrigated only once ; in the same way the area of a field irrigated two out of three years only came into the account once.

119. *Q.* Taking a number of years, do you get to 60 per cent. in any year ?—No ; certainly not.

120. *Q.* Then what does this 59·78 per cent. show ?—It shows the area that gets water when it requires it and that pays a wet rate.

121. *Q.* But not the area that could be irrigated each year ?—No ; it is more than that.

122. *Q.* We cannot conclude that that proportion is commanded or protected against famine ?—I think it is protected against famine by means of irrigation.

123. *Q.* (*The President.*)—What you mean is that you can put that area down to the credit of that well. In an ordinary year it would be enough to command it ?—And equally in a famine year.

124. *Q.* (*Mr. Rajaratna Mudaliar.*)—Do you furnish the tenant with any document showing the previous rent and the rent under the re-settlement. In carrying out your re-settlement the zamindar gets a *patta*. The tenant has no document from the Settlement Officer ?—Not unless there is a case about it, and it is only then that the settlement officer has anything to do with the tenants.

125. *Q.* (*Mr. Roberts.*)—The rents are attested before the tenants ?—Yes, but he gets no paper about that.

126. *Q.* (*Mr. Rajaratna Mudaliar.*)—That rent is recorded in the *jamabundi* ?—To begin with, a slip is drawn out showing the amount of land and the rent and other particulars of each tenant's holdings. That is sent to the tenant and he has to verify it before the Deputy Collector.

127. *Q.* I ask the question simply to find out whether a tenant has any means of knowing what abatement you grant in case of improvements ?—That would only come up before the Settlement Officer when there was a case for enhancement and the whole thing would be brought out in Court.

128. *Q.* You take into account in the fixing of your rentals the improvement made by the tenants ?

(***Mr. Roberts.***)—The Settlement Officer does not settle the rents ; he only settles rents in case of dispute between the tenant and zamindar.

(***Mr. Rajaratna Mudaliar.***)—Are there any cases where the improvements are registered ?

(***Mr. Roberts.***)—He does not take into account tenants' improvements.

(***Witness.***)—It is only when there is a case of enhancement that the question occurs at all.

129. *Q.* (***Mr. Rajaratna Mudaliar.***)—I believe the owner's rate is fixed on the area commanded ?—No, on the area actually irrigated.

130. *Q.* That varies from year to year ?—Yes.

131. *Q.* That is charged only when canal irrigation is provided. Where the old source is improved by the introduction of a canal, is any owner's rate charged ? I mean, for instance, if canal irrigation takes the place of well irrigation ?—No.

132. *Q.* The owner does not pay anything for this improved irrigation ?—No. As a matter of fact, the rule now is that no owner's rate is to be charged in a village in which there is any canal irrigation existing at all at settlement.

✓133. *Q.* In answer to Question 11 you say "water-logging and the spread of salt efflorescence have been bitterly complained of, not only in this settlement, but in those of Muzaffarnagar and Bulandshahr, as due to the canal. I believe that the canal is partly, if it is not wholly or even chiefly, the cause of these evils." Was any abatement granted on that account in the re-settlement, do you know ?

(***Witness.***)—You mean actual reduction of revenue ?

(***Mr. Rajaratna Mudaliar.***)—Yes. I should think in places there were reductions. In all these ***khadir*** tracts there were very large reductions.

134. *Q.* In such cases as those referred to by you, reductions will be granted?—It is merely a question whether the rental is higher now than at the last settlement or not. It may be higher in spite of these disadvantages.

135. *Q.* In answer to Questions 35 and 36 you say "the produce in well-irrigated land is larger than in canal-irrigated, and that therefore the increase in the value of produce due to such irrigation is greater." How do you make out that?—That is about what one is always told.

136. *Q.* What is the reason of it?

(*The President.*)—I think the reason used to be in my time that where the well was there used to be the best bit of land in the village.

137. *Q.* (*The President to witness.*)—You have had a good deal of experience of the relations existing between the Revenue Officers and the Canal Officers. Do you think the system works satisfactorily?—I do not know what change one could suggest.

138. *Q.* For instance, the Revenue Officers should collect the canal rent and measure up the areas, while the professional officers should confine their attention to professional questions. Do you see any objection to that system?—No, I do not, except that it would mean a revolution in the whole department.

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139. *Q.* Would not that save the time of the professional officer which is now vested in attending to revenue management?—No, I think it would increase the work, because the Canal Officer has to go about, as it is now, and if he were restricted to his professional duty, he would go all about the canal looking at it from the professional side. At present he goes about looking at the distribution and complaints by the cultivators. Suppose a tenant says "my fields have dried up and I should not be charged any rate." Under your system it would either mean that a Revenue Officer would have to make a special visit to the place, or he would pass it on the Canal Officer for enquiry in which case you end at where we are now.

WITNESS No. 16.—KUAR SHIVNATH SINHA, Bijnor.

Kuar Shivna Sinha

24th Nov

1. *Q.* (*The President.*)—You are a resident of Bijnor?—Yes.

2. *Q.* Are you a landlord there?—Yes.

3. *Q.* What amount of land have you got?—We have about 300 villages.

4. *Q.* What irrigation have you?—We have got two Government canals in the district—the Khoh and the Gangan.

5. *Q.* They are small canals, I understand?—Yes. The Gangan is carried through any part of the world; the Khoh is a long way off.

6. *Q.* Do you derive much irrigation from that canal?—We have some villages on the canal; most of them are not, however.

7. *Q.* Is the irrigation satisfactory on the canal?—No, it is not. They have not enough water.

8. *Q.* Such as it is, can you rely on it?—It so happened last time when we had a famine in 1896-97. There was not enough water.

9. *Q.* That was because there was not enough water in the stream; was it not?—Yes; and occasionally it happens that while the crops in the villages are waiting for water, the waiting makes them suffer. When they want it very badly they cannot get the water, and the result is that the crops suffer.

10. *Q.* I suppose they take all the water they can get?—Yes.

11. *Q.* Is there any complaint against the Canal Department about the water?—There is a complaint about not receiving the water, and also about the rates being put on in a slipshod manner. At present the canal officer assesses the lands in quite an unsatisfactory manner. I might mention that it would be a very good thing for the district if they had the Ramganga Canal. It is quite possible. I believe some years ago the project about the Ramganga Canal was taken out, but it somehow or another was shelved. The country through which the Ramganga passes is lower than the rest of the country, and I believe it was a question of expense; otherwise it was quite feasible.

12. *Q.* That would benefit you?—That would benefit not only the Bijnor district, but also Moradabad and Badaun.

13. *Q.* Has the Ramganga always water?—Yes. It is a perpetual stream; it never runs dry.

14. *Q.* These lands that have not canal irrigation, do they depend upon wells?—Yes, they do.

15. *Q.* Is there a great deal of well irrigation?—A great deal.

16. *Q.* You have a pretty good rainfall in Bijnor; have you not?—We have about 46 inches, I think. Mr. Roberts would know more about it than I do.

17. *Q.* Is there much extension of well irrigation?—I believe there are more wells now than there used to be in the old days. There is more *takavi* given now by Government and it is taken freely; we give it in our own estates too.

18. *Q.* Have you extended the area under well irrigation?—I think it has nearly doubled itself.

19. *Q.* Since when?—Within the last ten years.

20. *Q.* Probably there have been a number of *kachcha* wells dug in the last few years?—Yes, a great number of them. The district produces mostly sugarcane and that requires a great deal of irrigation.

21. *Q.* Is there free application made to the Collector for *takavi* advances?—Not quite so free as one would like to see, because people are afraid of getting less than is usually given by Government. When the advances are given by the officer himself, it is all right; but if they have to pass through other hands then the people do not get it all.

22. *Q.* What do you think would be the remedy for that?—I believe the remedy lies in what has been done lately. The pargana officer distributes the money himself, and he money has gone into the proper hands then.

23. *Q.* Is there a complaint made against the rate of interest being too high?—No; I have never heard that.

24. *Q.* Or, as regards the number of years in which the people are required to repay the loans?—No; I have not heard that.

25. *Q.* I suppose it is five or six years?—I believe so.

26. *Q.* (*Mr. Roberts.*)—What kind of *takavi* are you talking about now?—The *takavi* given for purchasing bullocks and so on, but not for wells.

27. *Q.* Supposing another bad season came on like you had in Bijnor, what would be the best way to protect that district?—Have the canals in the district.

28. *Q.* Would the feeling be very general in favour of that?—I think it would be.

✓29. *Q.* Is there any fear of water-logging in Bijnor?—Yes, because there are numerous streams which overflow in the rainy season. There might be aqueducts or anything to allow the water to escape.

✓30. *Q.* But if there is a canal made, that would be attended to?—Would be very popular both among the zamindar and tenants, because it would protect the district from scarcity.

31. *Q.* (*Mr. Rajaratna Mudaliar.*)—In several years the supply from the canal was scanty. Did you get any remission of the rates?—Yes, the petty zamindars did.

32. *Q.* Do you pay owner's rate on the area actually irrigated each year or upon the commanded area?—We do not pay owner's rate in Bijnor now. We pay on the commanded area; so far as I understand, the area that is on the records of the canal department.

33. *Q.* Whether you irrigate the land or not?—The general complaint is that even if a tenant does not require water, and it comes into his field from overflow, that is counted and assessed as irrigation, although he does not ask for water. If his land lies within the area of irrigation by the canals he will be charged.

34. *Q.* (*Mr. Roberts.*)—Why does he leave his field unirrigated?—Because he does not want the crop in that field that year.

35. *Q.* (*Sir Thomas Higham.*)—Whether he grows crop or not?—Yes.

36. *Q.* Is there any rule? Is it done by the State?—It is done by the department, I believe.

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37. *Q.* (*The President.*)—Will you write a statement of that?—It ought to be enquired into.

38. *Q.* (*Mr. Rajaratna Mudaliar.*)—The measurement and assessment of the irrigated area is done by the canal department. Would you prefer to see this work entrusted to the Revenue Officers?—I think it would be more correctly done. The canal department do not know and do not often ask the assistance of the *patwari* of the village, and they put wrong names and we have to realise it from the tenants. If the wrong name is entered in their *jamabandi*, we cannot sue anybody.

39. *Q.* You can get that mistake corrected?—With a great deal of trouble and rather than go through that inconvenience we pay up.

40. *Q.* Does not the *patwari* go with the patrol?—Not always.

41. *Q.* (*Mr. Roberts.*)—Which canal?—Of my own district, the Gangan and the Khoh.

42. *Q.* There is very little irrigation from that?—At least 2,000 or 3,000 acres, speaking of our own estates only.

43. *Q.* (*Mr. Rajaratna Mudaliar.*)—What area is usually irrigated by a well in a season?—By *kachcha* well about 10 acres; by *pakka* well double that.

44. *Q.* How often would that area require irrigation?—About three times a month in a dry season; in an ordinary season twice.

45. *Q.* Are the orders about exemption from enhancement for private improvement clearly understood?—Not very.

46. *Q.* In your own estate what abatement have you received?—Not any.

47. *Q.* (*Mr. Roberts.*)—Did you make application?—No. We have not constructed many wells for irrigation, because the tenants prefer irrigating from *kachcha* wells; they are afraid of enhanced rates.

48. *Q.* On *kachcha* wells you do not enhance the rent?—No; in fact, we give them money for them.

49. *Q.* Would you like to see the period of repayment for *takavi* extended to 25 years in the case of wells?—No. I should not like to see that six years will be enough if money is taken in instalments.

I have the honour to submit the following additional remarks on my evidence given before the Commission at Allahabad on the 24th ultimo, as desired by the Honourable President.

The irrigated area in this district can be approximately ascertained from the following figures, and for the sake of convenience I give the mileage of the canals also.

The area irrigated in 1889 to 1900 was—

	Acres.
Nagina system	12,153
Nehtor „	6,898
Total .	19,051

Mileage.	M.	F.
Nagina canals and its branches .	41	4
Nehtor canals and its branches .	25	4
Tajpore minor	5	4½
Total .	72	4½

The remarks in my evidence regarding the overflow charges referred chiefly to the Gangan river which is treated in this district as a canal, a fair amount of irrigation being available during the winter months for the *rabi* crop and in the hot weather for sugarcane. The Gangan is a natural river, having its source in the jungle beyond Najibabad and has high banks, which have, as far as I am aware, required no repairs or any outlay for their repairs. Irrigation is always done by bunding it under the direction of one of the canal patrols and is mostly resorted to in the pargana of Boorhpur. Formerly the river was free and bunds were put up as the water was required. Sometime before 1866-67 Government commenced to levy a small water rate and subsequently the river being declared in the *Gazette*, it was made over to the Canal Department, who have ever since treated it in all respects as a canal. All the water which goes into the fields from it, whether in the winter months, hot weather or *the rains*, is charged for. The river is generally in flood in the rains when no water is needed from it, with the result that it overflows its banks; all this being subsequently charged for by the Canal Department. It cannot reasonably be supposed that a natural river which feeds a whole system of canals in the district in the dry months can have its water under control in the rains and specially when they are heavy, but I would earnestly submit that the demand which is made for the overflow or the flood water in the rains is anything but reasonable, to say nothing of its legality. The poor tenants more often than not suffer from the excessive watering which in the rains their fields do not need. I would therefore respectfully call the attention of the Commission to this fact and hope that through their recommendation the extraordinary practice of charging for flood water in the pargana be put a stop to. Of course the tenants never demur to paying legitimate charges, but they groan under this heavy burden.

The utility and popularity of canals in this district can be judged from the remarks which Mr. A. T. Holme, Canal Officer, makes in his settlement report of the pargana and which I take the liberty of quoting here. He says: "The canal irrigation in Circle I is supplied by the Nehtor Canal, which derives its water from the Gangan river at Nehtor. This canal was at first completed in 1850 at a cost of Rs. 1,200 and was remodelled some six years ago at a further cost of Rs. 39,000. Its mileage is now (including minor channels) about 26 miles. In 1866-67 the area irrigated was 392 acres and the receipts were Rs. 289. Thirty years later in 1896-97, when there was a great demand for water the canal was able to irrigate 13,136 acres, the receipts being Rs. 20,519. These figures speak for themselves. The Gangan river, which is tapped at Nehtor, runs its course through the Boorhpore pargana and, as I have shown above, is treated as a canal.

The popularity of canals in this district is due mainly to the fact that masonry wells very soon silt up and are not of much use for irrigation purposes, as the water-supply is precarious. *Kachcha* wells which cost little are much in vogue, but they do not last long and are consequently dug in fresh ground every year, with the exception of a tract near Pherua in the pargana of Chandpur in this district, where *kachcha* wells are known to stand for 20 years, there is no hard soil with good water springs, and indeed in some parts it is so bad that wells fall in the moment they are dug. A canal from the Ramganga would therefore be a boon and pay its cost in six years. As the Khoh water is utilized by putting up a temporary bund, so could the Ramganga as a tentative measure and the water turned into the Khoh or not just as the occasion required. A *pakka* dam across Ramganga serving the purpose of a bridge as well will connect a tract of country which in the rains is cut off from all communication from the outside world to say nothing of the railways. In conclusion, I must apologise for the length of this note.

SEVENTEENTH DAY.

Lucknow, 27th November 1902.

Mr. W. H. Moreland.

27th Nov. 02.

WITNESS NO. 17.—MR. W. H. MORELAND, Director of Land Records and Agriculture, United Provinces of Agra and Oudh.

Report on paragraphs 6, 8, 9, and 10 of the memorandum of points to be considered by the Irrigation Commission in the United Provinces.

Introductory.—The orders calling for this report reached me on September 11th, leaving nine days for its preparation. Of these, two days were necessarily consumed in transit of papers; the period of seven days has not permitted of anything beyond a compilation of such information as was on record in my office.

Paragraph 6.—Proportion of the average area annually sown which, in the light of recent experience

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must be matured to ensure a tract against a famine.—No figures are on record which would enable me to make such an estimate. Our recent experience does not include a failure of the *rabi*, which is nearly half of the area annually sown. Even for the *kharif* the actual figures of area matured in the famine year 1896 are not on record, as the rules for recording crop failure were not at the time in working order. The Resolution on the Administration of Famine Relief during 1896 and 1897 contains estimates, necessarily open to considerable errors, of the *outturn* of the *kharif* (*vide* the map prefixed to Chapter IV.)

This map brings out clearly the objections to offering any estimates of the kind asked for; one of the points most clearly brought out by the course of that famine was the effect of previous years of moderate depression, and any estimate which neglects this feature must be misleading. The grouping of the Benares and Oudh districts in the map just referred to shows this clearly.

Since 1896 there has been no crop failure on a sufficient scale to enable any inferences to be drawn.

Proportion of the normal rabi area which must be irrigated to ensure a tract against famine.—Here, again, recent experience does not enable me to give an estimate of any value, as there has in recent years been no considerable failure of the *rabi* due to drought. Last year, 1309 *fasli*, was a dry cold weather, and there was a very good *rabi*: about 46 per cent. of the area sown was irrigated.

It is not even possible to say accurately what the normal *rabi* area now is. The normals in use in the last decade were the averages of 1300—1302 *fasli*; since then there has not been a series of years of normal prosperity sufficiently long to enable a fresh set of normals to be calculated.

The old normal was approximately 20½ millions of acres, while the figures for the more normal years since 1896 suggest a normal of about 19 millions, there having undoubtedly been a reaction from the rapid extension of the *rabi* which characterized the years up to 1893 or 1894.

The experience of the famine year is hardly in point, as famine was existing when the *rabi* was irrigated.

Situation, areas, and population of districts or tracts which, in the absence of artificial irrigation, would be liable to suffer from drought.—Practically the whole of the provinces comes under this description. A reference to the map in Chapter IV of the Resolution on the famine of 1896 and 1897, already quoted, will show that there was a serious loss of the *kharif* even in the damp submontane districts in Gonda and Basti, for instance, more than 60 per cent. of the *kharif* of 1896 was lost, and there was famine in both districts. Even in Bahraich and Ballia, where relief measures were unnecessary, more than one-third of the crop was lost.

Artificial irrigation can, however, do comparatively little towards saving the *kharif* in a season of severe drought. Considering the *rabi* alone, if wells and canals were to fail, and there were to be no rain from December to March, the crops must suffer very severely, except in the lowlands along the rivers and, perhaps, in the extreme north of the province. These tracts are not, however, defined, and figures for their area and population cannot be given, nor can an accurate map be prepared.

Proportion in each district or tract which the area irrigated in dry years bears to the normal rabi area.—Figures for separate tracts are not immediately available. The annexed statement shows for each district the proportions irrigated in 1897, the famine year, and in 1900 and 1902 when there was great need of irrigation. The normals used are those of 1300—1302; as the *rabi* area has somewhat decreased since then, the proportions should probably be a little higher all round.

The blanks in the statement are due to the fact that annual figures are not received while a district is under survey or settlement.

Statement showing proportion in each district which the area irrigated in dry years bears to the normal rabi *area.*

Division.	District.	(a) Normal *rabi* area.	(b) *Rabi* irrigated area, 1896-97.	Percentage of (b) on (a).	(c) *Rabi* irrigated area, 1899-1900.	Percentage of (c) on (a).	(d) *Rabi* irrigated area, 1901-1902.	Percentage of (d) on (a).
	PROVINCE OF AGRA.							
MEERUT.	Dehra Dun . .	50,159	17,601	35	20,296	40	19,455	39
	Saharanpur . .	565,959	130,341	23	157,863	28	130,978	23
	Muzaffarnagar .	438,454	208,258	47	241,937	55	226,238	52
	Meerut . .	688,959	...	...	...	...	401,009	58
	Bulandshahr . .	585,724	335,164	57	421,047	72	354,139	60
	Aligarh . .	589,460	441,926	75	...	...	...	...
AGRA.	Muttra . .	383,573	230,109	60	199,440	52	191,179	50
	Agra . . .	412,586	240,478	58	209,109	51	210,140	51
	Farrukhabad .	377,352	228,593	61	...	...	...	...
	Mainpuri . .	374,491	311,064	83	...	...	...	...
	Etawah . .	321,770	238,258	74	...	...	177,473	55
	Etah . . .	393,836	278,172	71	...	...	...	...
ROHILKHAND.	Bareilly . .	462,222	97,416	21	...	...	...	...
	Bijnor . .	306,398	...	...	...	...	17,628	6
	Budaun . .	509,481	...	...	226,545	44	129,858	25
	Moradabad . .	557,413	49,450	9	164,930	30	40,586	7
	Shahjahanpur .	456,111	114,161	25	...	...	...	...
	Pilibhit . .	228,738	41,211	18	...	...	...	...
ALLAHABAD.	Cawnpore . .	473,921	287,166	61	241,404	51	247,699	52
	Fatehpur . .	332,547	102,870	31	137,627	41	123,130	37
	Banda . . .	503,880	5,395	1	5,630	1	4,813	1
	Hamirpur . .	397,084	18,067	5	19,197	5	17,212	4
	Allahabad . .	688,153	178,972	26	214,100	31	189,135	27
	Jhansi . . .	318,575	...	...	56,374	18	64,221	20
	Jalaun . . .	378,013	37,288	10	29,230	8	...	...
BENARES.	Benares . .	260,235	108,513	42	132,290	51	120,943	46
	Mirzapur . .	350,662	29,418	8	39,136	11	30,872	9
	Jaunpur . .	373,145	288,253	77	317,761	85	292,401	79
	Ghazipur . .	396,447	161,460	41	199,814	50	183,094	47
	Ballia . . .	336,321	130,269	39	175,834	52	145,297	44
GORAKHPUR.	Gorakhpur . .	1,203,037	472,728	39	681,046	57	602,237	50
	Basti . . .	717,326	429,367	60	536,151	75	522,601	73
	Azamgarh . .	458,109	335,704	73	...	...	...	...

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Statement showing proportion in each district which the area irrigated in dry years bears to the normal rabi *area*—continued.

Division.	District.	(*a*) Normal *rabi* area.	(*b*) *Rabi* irrigated area, 1896-97.	Percentage of (*b*) on (*a*).	(*c*) *Rabi* irrigated. area, 1899-1900.	Percentage of (*c*) on (*a*).	(*d*) *Rabi* irrigated area, 1901-1902.	Percentage of (*d*) on (*a*).
	PROVINCE OF AGRA —*continued.*							
KUMAUN.	Naini Tal (Plains) .	114,677	19,534	17	27,738	24	14,264	12
	OUDH.							
LUCKNOW.	Lucknow . .	202,625	89,517	44	109,068	54	100,664	50
	Unao . . .	387,280	160,890	42	213,271	55	198,415	51
	Rae Bareli . .	339,961	209,674	62	238,702	70	221,542	65
	Sitapur . .	574,226	96,687	17	170,888	30	154,610	27
	Hardoi . . .	592,904	...	...	234,670	40	...	...
	Kheri . . .	417,703	...	...	...	...	61,799	15
FYZABAD.	Fyzabad . .	418,563	247,976	59	294,838	70	264,043	63
	Gonda . . .	735,621	156,826	21	...	...	..	...
	Bahraich . .	590,679	...	...	79,291	13	68,959	12
	Sultanpur . .	361,025	224,560	62	255,093	71	232,812	64
	Partabgarh . .	313,307	199,782	64	227,694	73	204,223	65
	Bara Banki . .	474,843	178,201	38	212,262	45	203,464	43

Mean annual rainfall of each district or tract, years in which district or tract suffered from drought, and the rainfall of each of these years.—The attached statement shows the mean annual rainfall of each district, and the rainfall of 1896-97 and 1899-1900. The last column shows how the various districts were classified according to intensity of distress in 1896-97 : in 1899-1900 there was no actual distress, but the loss of produce was relatively greatest in Agra, Muttra, and Bijnor.

Statement showing mean annual rainfall of each district and the rainfall of two dry years.

Division.	District.	Mean annual rainfall (average of five years preceding the famine.)	Actual rainfall of 1896-97 (famine year.)	Actual rainfall of 1899-1900.	How classed in 1896-97 for famine relief.
	PROVINCE OF AGRA.				
MEERUT.	Dehra Dun	94·8	79·8	65·0	Scarcity.
	Saharanpur	44·4	27·6	23·8	
	Muzaffarnagar	36·2	20·0	18·5	
	Meerut	36·9	20·1	19·9	
	Bulandshahr	22·8	25·4	20·7	
	Aligarh	28·0	21·3	19·3	
	TOTAL .	43·9	32·4	27·9	
AGRA.	Muttra	27·6	15·2	16·6	Scarcity.
	Agra	27·9	12·1	20·2	Famine.
	Farrukhabad	39·2	15·1	32·1	Scarcity.
	Mainpuri	34·7	13·5	27·2	
	Etawah	35·5	16·7	28·9	Famine.
	Etah	32·0	15·7	28·5	Scarcity.
	TOTAL .	32·8	14·7	25·6	
ROHILKHAND.	Bareilly	50·0	35·1	35·3	Scarcity.
	Bijnor	52·6	37·1	27·6	
	Budaun	40·4	20·1	29·9	
	Moradabad	46·4	26·6	29·1	
	Shahjahanpur	43·2	23·9	28·7	
	Pilibhit	55·5	41·9	41·0	
	TOTAL .	48·0	30·8	31·9	

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Statement showing mean annual rainfall of each district and the rainfall of two dry years—continued.

Division.	District.	Mean annual rainfall (average of five years preceding the famine.)	Actual rainfall of 1896-97 (famine year.)	Actual rainfall of 1899-1900.	How classed in 1896-97 for famine relief.
	PROVINCE OF AGRA—*continued.*				
ALLAHABAD.	Cawnpore	39·8	18·7	40·0	Famine.
	Fatehpur	45·6	18·7	43·6	
	Banda	47·6	17·9	44·5	
	Hamirpur	44·7	28·3	42·0	
	Allahabad	44·2	21·8	46·1	
	Jhansi	41·3	32·4	27·2	
	Jalaun	38·2	20·8	29·2	
	TOTAL	43·1	22·7	90·4	
BENARES.	Benares	40·2	27·9	51·7	Scarcity.
	Mirzapur	46·5	31·3	49·9	Famine.
	Jaunpur	47·3	22·9	46·1	
	Ghazipur	40·0	25·9	46·8	
	Ballia	41·6	28·1	58·7	
	TOTAL	43·1	27·2	50·6	
GORAKHPUR.	Gorakhpur	50·6	29·1	72·4	Famine
	Basti	54·1	31·6	55·7	Scarcity.
	Azamgarh	46·9	17·8	53·3	Famine.
	TOTAL	50·5	26·1	60·5	
KUMAUN.	Almora	64·5	55·3	61·2	Not classified.
	Garhwal	59·9	51·4	52·2	
	Naini Tal	69·3	49·3	52·4	
	TOTAL	64·6	52·0	55·6	
	TOTAL PROVINCE OF AGRA	46·6	29·4	48·9	
	OUDH.				
LUCKNOW.	Lucknow	42·4	23·9	33·3	Famine.
	Unao	40·9	18·8	40·3	
	Rae Bareli	45·6	14·8	45·6	
	Sitapur	43·6	26·4	37·5	
	Hardoi	43·6	18·1	30·9	
	Kheri	52·5	41·4	43·7	Scarcity.
	TOTAL	44·8	23·9	38·5	
FYZABAD.	Fyzabad	46·9	30·8	54·5	Scarcity.
	Gonda	49·8	30·5	47·2	
	Bahraich	50·0	42·4	34·4	
	Sultanpur	54·3	24·4	46·5	Ditto.
	Partabgarh	45·5	20·5	47·4	
	Bara Banki	45·4	23·0	36·7	Famine
	TOTAL	48·6	28·6	44·4	
	TOTAL OUDH	46·7	26·2	41·4	
	TOTAL U. P. OF AGRA AND OUDH	46·7	27·8	45·1	

Paragraph 8. Wells.—The attached statements show the number of wells, the area irrigated, and such information as to spring level as is available.

Column 5 has been divided to show the half-masonry wells, which are returned separately from the masonry. No information is available in this office regarding the amount of *takavi* given for wells or the number of wells constructed or repaired by their means: the figures may possibly be on record in the Board's office. Recent figures for the average cost of wells are not available in my office for different districts, nor is there a record of the average gross area irrigated annually by each kind of well.

The depth to spring level is taken from a map prepared in 1884-85: no general survey has been made since then, and doubtless there have since been changes in some localities, while it may be conjectured that the level is at present a little lower all round owing to the series of dry years since 1895. Two years ago a marked fall in the level of wells was reported from parts of Muttra, Aligarh, and Etah.

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Statement showing the number of wells in use for irrigation during each of the past ten years, and cultivated area irrigated by the wells in each year, etc., etc., in each district and province.

District.	Year.	Number of wells.					Area irrigated from wells.	Amount of *takavi* advanced for wells.	Number of wells constructed or repaired by means of *takavi*.		Brief note showing average depth to water surface, average cost of each class of wells, average gross area irrigated annually by each, etc.
		Masonry.		Earthen.							
		Constructed during the year.	Total at end of year.	Half-masonry.	Earthen.	Total of columns 4 and 5.			Constructed.	Repaired.	
1	2	3	4	5a	5b	6	7	8	9	10	11
DEHRA DUN.	1891-92	...	31	1	24	56	13	...	...	...	
	1892-93	...	31	...	13	44	1	...	...	...	
	1893-94	...	31	...	13	44	3	...	...	...	
	1894-95	...	31	...	10	41	3	...	...	...	
	1895-96	...	31	...	...	31	16	...	...	...	
	1896-97	...	31	...	9	40	31	...	...	...	
	1897-98	...	31	...	9	40	28	...	...	...	
	1898-99	...	31	...	16	47	32	...	...	...	
	1899-1900	...	31	...	14	45	17	...	...	...	
	1900-01	...	31	...	12	43	11	...	...	...	
	Total	...	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	...	—1	—12	—13	—2	...	...	...	
SAHARANPUR.	1891-92	40	4,241	36	1,695	5,972	31,836	...	...	...	Spring level at depths 10 to 20 feet.
	1892-93	34	4,265	50	1,631	5,946	27,551	...	...	...	
	1893-94	107	4,270	43	1,460	5,773	28,705	...	...	...	
	1894-95	29	4,278	48	1,277	5,603	6,452	...	...	...	
	1895-96	37	4,279	66	1,165	5,509	28,898	...	...	...	
	1896-97	87	4,348	49	2,322	6,719	55,572	...	...	...	
	1897-98	25	4,371	62	2,175	6,608	46,037	...	...	...	
	1898-99	12	4,382	63	1,838	6,283	40,479	...	...	...	
	1899-1900	45	4,420	53	3,126	7,599	72,787	...	...	...	
	1900-01	74	4,468	72	2,333	6,873	16,627	...	...	...	
	Total	490	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+227	+36	+638	+901	—15,209	...	...	...	
MUZAFFARNAGAR.	1891-92	18	6,087	57	2,242	8,386	61,032	...	...	...	Spring level at depths from below 10 to 40 feet.
	1892-93	59	6,143	64	2,429	8,636	56,520	...	...	...	
	1893-94	43	6,137	62	2,411	8,610	63,891	...	...	...	
	1894-95	...	5,970	57	2,103	8,130	25,661	...	...	...	
	1895-96	9	5,976	46	2,048	8,070	61,390	...	...	...	
	1896-97	156	6,126	50	2,758	8,934	102,086	...	...	...	
	1897-98	118	6,229	27	2,587	8,843	82,017	...	...	...	
	1898-99	19	6,248	30	2,646	8,924	81,005	...	...	...	
	1899-1900	121	6,359	31	7,073	13,463	116,068	...	...	...	
	1900-01	40	6,396	30	3,006	9,432	48,524	...	...	...	
	Total	583	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+309	—27	+764	+1,046	—12,508	...	...	...	
MEERUT.	1891-92	163	11,732	1,107	4,992	17,831	129,330	...	...	...	Spring level at depths from below 10 to 40 feet.
	1892-93	132	11,651	1,055	4,857	17,563	111,763	...	...	...	
	1893-94	193	11,677	1,055	4,723	17,455	118,406	...	...	...	
	1894-95	*									
	1895-96										
	1896-97										
	1897-98										
	1898-99										
	1899-1900										
	1900-01										
	Total 3 years	488	...	...	...	...	...	...	...	...	
	+ or — in 1893-94 as compared with 1891-92.	...	—55	—52	—269	—376	—10,924	...	...	...	

* Figures not available.

NOTE.—*Column 4.*—The number of wells shown in this column is the number at end of previous year *plus* number constructed during the year *minus* number fallen in during the year.

Column 7—Shows the cultivated area irrigated and not the gross (cropped) area, *i.e.*, it does not include double cropped area, irrigation figures for which are not available.

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Statement showing the number of wells in use for irrigation during each of the past ten years, and cultivated area irrigated by the wells in each year, etc., etc., in each district and province—continued.

District.	Year.	Number of wells.					Area irrigated from wells.	Amount of *takavi* advanced for wells.	Number of wells constructed or repaired by means of *takavi*.		Brief note showing average depth to water surface, average cost of each class of wells, average gross area irrigated annually by each, etc.
		Masonry.		Earthen.		Total of columns 4 and 5.					
		Constructed during the year.	Total at end of year.	Half-masonry.	Earthen.				Constructed.	Repaired.	
1	2	3	4	5*a*	5*b*	6	7	8	9	10	11
BULANDSHAHR.	1891-92	181	9,102	2,460	3,550	15,112	168,549	...	...	...	Spring level at depths from below 10 to 40 feet.
	1892-93	240	9,025	2,563	3,326	14,914	125,350	...	...	...	
	1893-94	166	9,095	2,579	2,902	14 576	118,595	...	...	...	
	1894-95	113	9,117	2,587	2,175	13,879	34,659	...	...	...	
	1895-96	217	9,231	2,603	2,522	14,356	144,899	...	...	...	
	1896-97	342	9,467	2,763	3.644	15,874	193,522	...	...	...	
	1897-98	315	9,671	2,949	3.753	16,373	174,744	...	...	...	
	1898-99	312	9,859	3,100	3.765	16,724	184,040	...	...	...	
	1899-1900	302	10,101	3,252	4,786	18,139	232,094	...	...	...	
	1900-01	235	10,242	3,256	4,271	17,769	74,844	...	...	...	
	Total	2,423	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+1,140	+796	+721	+2,657	—93,705	...	...	...	
ALIGARH.	1891-92	212	11,380	2,400	25,534	39,314	310,948	...	...	...	Spring level at depths 10 to 40 feet.
	1892-93	212	11,093	2,458	25,155	38,706	270,932	...	...	...	
	1893-94	188	11,100	2,320	25,185	38.605	291,306	...	...	...	
	1894-95	419	11,128	2,556	23,382	37,066	161,206	...	...	...	
	1895-96	372	11,396	2.682	25,378	39 456	295,077	...	...	...	
	1896-97	261	11,417	2,832	29,374	43.623	368,450	...	...	...	
	1897-98	226	11,471	3,218	28,643	43,332	316,906	...	...	...	
	1898-99	207	11,557	3,194	30,002	44,753	334,317	...	...	...	
	1899-1900	*									
	1900-01										
	Total, 8 years	2,097	...	...	...	...	...	...	...	...	
	+ or — in 1898-99 as compared with 1891-92.	...	+177	+794	+4,468	+5,439	+23,369	...	...	...	
MUTTRA.	1891-92	85	6,563	223	27,522	34,308	144,046	...	...	..	Spring level at depths 20 to 60 feet.
	1892-93	65	6,528	193	27,827	34,548	136,152	...	...	...	
	1893-94	97	6,590	219	28,871	35,680	138,741	...	...	...	
	1894-95	70	6,600	206	28.654	35,460	99,004	...	...	...	
	1895-96	48	6,611	212	29,975	36.798	140,727	...	...	...	
	1896-97	87	6,657	264	30,977	37,898	181,826	...	...	...	
	1897-98	87	6,692	297	31,380	38,369	134,599	...	...	...	
	1898-99	71	6,706	307	31,549	38,562	152,754	...	...	...	
	1899-1900	119	6,754	327	30,271	37,352	166,816	...	...	...	
	1900-01	60	6.744	315	30,250	37,309	100,974	...	...	...	
	Total	789	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+181	+92	+2,728	+3,001	—43,072	...	...	...	
AGRA.	1891-92	188	10,252	656	52.338	63,246	199.726	...	...	...	Spring level at depths 10 to 80 feet or above.
	1892-93	115	10,286	696	53,065	64,047	196,630	...	...	...	
	1893-94	213	10,368	742	55,431	66,541	199,243	...	...	...	
	1894-95	123	10,412	773	52,500	63,685	120,807	...	...	...	
	1895-96	159	10.436	782	55,092	66,310	201.980	...	...	...	
	1896-97	151	10,549	834	61,250	72,633	260,835	...	...	...	
	1897-98	144	10,623	851	55,556	67,030	185,513	...	...	...	
	1898-99	148	10,679	871	56,978	68,528	195,453	...	...	...	
	1899-1900	126	10,762	904	60,603	72,269	238,811	...	...	...	
	1900-01	151	10.871	891	58,105	69,867	152,251	...	...	...	
	Total	1,518	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+619	+235	+5,767	+6,621	—47,475	...	...	...	

* Figures not available.

Mr. W. H. Moreland.

27th Nov. 02.

Statement showing the number of wells in use for irrigation during each of the past ten years, and cultivated area irrigated by the wells in each year, etc., etc., in each district and province—continued.

District.	Year.	Number of wells. Masonry. Constructed during the year.	Masonry. Total at end of year.	Earthen. Half-masonry.	Earthen. Earthen.	Total of columns 4 and 5.	Area irrigated from wells.	Amount of *takavi* advanced for wells.	Number of wells constructed or repaired by means of *takavi*. Constructed.	Repaired.	Brief note showing average depth to water surface, average cost of each class of wells, average gross area irrigated annually by each, etc.
1	2	3	4	5a	5b	6	7	8	9	10	11
FARRUKHABAD.	1891-92	176	2,271	4,056	33,736	40.063	120,201	...	...	...	Spring level at depths from below 10 to 40 feet.
	1892-93	151	2,377	4,612	33,821	40,810	111,217	...	...	...	
	1893-94	112	2,436	4.691	31,878	39,005	99,743	...	...	...	
	1894-95	85	2,489	4,766	24,830	32,085	31,624	...	...	...	
	1895-96	116	2,576	5,088	32,870	40,534	115,764	...	...	...	
	1896-97	175	2,717	5,776	48,409	56,902	175,081	...	...	...	
	1897-98	*									
	1898-99										
	1899-1900										
	1900-01										
	Total, 6 years	815	...	...	...	...	...	...	...	...	
	+ or — in 1896-97 as compared with 1891-92.	...	+446	+1,720	+14,673	+16,839	+54,880	...	...	...	
MAINPURI.	1891-92	277	9,271	2,756	18,659	30,686	155,438	...	...	...	Spring level at depths from below 10 to 40 feet.
	1892-93	284	9,135	2,449	17,070	28,654	153.258	...	...	...	
	1893-94	258	9,233	2,508	15,801	27,542	148,155	...	...	...	
	1894-95	147	9,282	2,616	9,307	21,205	28,646	...	...	...	
	1895-96	280	9,424	2,720	14,350	26,494	158,394	...	...	...	
	1896-97	450	9,685	2,753	21,746	34,184	205,848	...	...	...	
	1897-98	309	9,897	2,671	19,692	32,260	165,225	...	...	...	
	1898-99	177	9,969	2,879	19,339	32,187	172,645	...	...	...	
	1899-1900	*									
	1900-01										
	Total, 8 years	2,182	...	...	...	...	...	...	...	...	
	+ or — in 1898-99 as compared with 1891-92.	...	+698	+123	+680	+1,501	+17,207	...	...	...	
ETAWAH.	1891-92	249	3,650	445	10,406	14,501	54,673	...	...	...	Spring level at depths 10 to 80 feet and above.
	1892-93	160	3,716	441	10,338	14,495	53,696	...	...	...	
	1893-94	209	3,728	378	9,233	13,339	43,546	...	...	...	
	1894-95	105	3,757	371	5,728	9,856	9,786	...	...	...	
	1895-96	186	3,891	409	8,583	12,883	53,044	...	...	...	
	1896-97	225	4,014	504	12,181	16,699	78.771	...	...	...	
	1897-98	242	4,145	479	10,451	15,075	61,580	...	...	...	
	1898-99	198	4,130	496	10,526	15,152	56,894	...	...	...	
	1899-1900	*									
	1900-01	349	4,429	462	9,040	13,931	35,071	...	...	...	
	Total, 9 years	1,923	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+779	+17	—1,366	—570	—19,602	...	...	...	
ETAH.	1891-92	135	2,189	8,393	20,298	30,880	154,249	...	...	...	Spring level at depths 10 to 40 feet.
	1892-93	68	2,147	8,264	17,909	28,320	142,165	...	...	...	
	1893-94	58	2,147	8,572	16,439	27,158	135,177	...	...	...	
	1894-95	31	2,135	8,522	10,306	20,963	30,833	...	...	...	
	1895-96	73	2,180	8,805	17,230	28,215	146,852	...	...	...	
	1896-97	95	2,251	9,271	31,410	42.932	200,443	...	...	...	
	1897-98	106	2,312	8,831	26,050	37,193	174,071	...	...	...	
	1898-99	56	2,310	9,860	23,720	35,890	165,677	...	...	...	
	1899-1900	*									
	1900-01										
	Total, 8 years	622	...	...	...	...	...	...	...	...	
	+ or — in 1898-99 as compared with 1891-92.	...	+121	+1,467	+3,422	+5,010	+11,428	...	...	...	

* Figures not available.

Mr. W. H. Moreland.

27th Nov. 02.

Statement showing the number of wells in use for irrigation during each of the past ten years, and cultivated area irrigated by the wells in each year, etc., etc., in each district and province—continued.

District.	Year.	Number of wells. Masonry. Constructed during the year.	Number of wells. Masonry. Total at end of year.	Number of wells. Earthen. Half masonry.	Number of wells. Earthen. Earthen.	Number of wells. Total of columns 4 and 5.	Area irrigated from wells.	Amount of *takavi* advanced for wells.	Number of wells constructed or repaired by means of *takavi*. Constructed.	Number of wells constructed or repaired by means of *takavi*. Repaired.	Brief note showing average depth to water surface, average cost of each class of wells, average gross area irrigated annually by each, etc.
1	2	3	4	5a	5b	6	7	8	9	10	11
BAREILLY.	1891-92	21	562	952	26,630	28,144	40,438	...	...	...	Spring level at depths from below 10 to 40 feet.
	1892-93	20	571	927	30,533	32,031	47,594	...	...	...	
	1893-94	29	581	220	21,768	22,569	25,373	...	...	...	
	1894-95	6	584	255	18,482	19,321	21,518	...	...	...	
	1895-96	5	589	238	31,192	32,019	49,688	...	...	...	
	1896-97	*									
	1897-98										
	1898-99										
	1899-1900										
	1900-1901										
	Total, 5 years	81	...	...	...	...	...	..	...	...	
	+ or — in 1895-96 as compared with 1891-92.	...	+27	—714	+4,562	+3,875	+9,250	...	...	...	
BIJNOR.	1891-92	...	135	2	8,145	8,282	16,644	...	...	...	Spring level at depths 10 to 40 feet.
	1892-93	...	135	2	8,511	8,648	15,799	...	...	...	
	1893-94	*									
	1894-95										
	1895-96										
	1896-97										
	1897-98										
	1898-99										
	1899-1900										
	1900-1901	...	141	9	8,982	9,132	17,023	...	...	...	
	Total, 3 years	...	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+6	+7	+837	+850	+379	...	...	...	
BUDAUN.	1891-92	55	5,380	217	41,336	46,933	92,105	...	...	...	Spring level at depths from below 10 to 40 feet.
	1892-93	*									
	1893-94										
	1894-95										
	1895-96										
	1896-97										
	1897-98										
	1898-99	12	5,509	325	48,272	54,106	68,401	...	...	...	
	1899-1900	40	5,540	311	93,333	99,184	197,680	...	...	...	
	1900-1901	41	5,578	221	36,122	41,921	40,351	...	...	...	
	Total, 4 years	148	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+198	+4	+5,214	—5,012	—51,754	...	...	...	
MORADABAD.	1891-92	33	750	119	50,494	51,363	67,782	...	...	...	Spring level at depths from below 10 to 20 feet.
	1892-93	1	736	117	42,747	43,600	59,968	...	...	...	
	1893-94	20	751	70	34,687	35,508	39,603	...	...	...	
	1894-95	22	755	83	50,027	40,865	41,203	...	...	...	
	1895-96	26	768	100	49,558	50,426	63,949	...	...	...	
	1896-97	3	770	108	62,195	63,073	89,865	...	...	...	
	1897-98	2	767	114	51,767	52,648	69,815	...	...	...	
	1898-99	14	777	112	40,870	41,759	48,917	...	...	...	
	1899-1900	8	785	153	86,705	87,643	188,363	...	...	...	
	1900-1901	6	791	105	37,782	38,678	44,626	...	...	...	
	Total	135	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+41	—14	—12,712	—12,685	—23,156	...	...	...	

* Figures not available.

Mr. W. H. Moreland.

27th Nov. 02.

Statement showing the number of wells in use for irrigation during each of the past ten years, and cultivated area irrigated by the wells in each year, etc., etc., in each district and province—continued.

District.	Year.	Number of wells.					Area irrigated from wells.	Amount of *takavi* advanced for wells.	Number of wells constructed or repaired by means of *takavi*.		Brief note showing average depth to water surface, average cost of each class of wells, average gross area irrigated annually by each, etc.
		Masonry.		Earthen.		Total of columns 4 and 5.					
		Constructed during the year.	Total at end of year.	Half-masonry.	Earthen.				Constructed.	Repaired.	
1	2	3	4	5a	5b	6	7	8	9	10	11
Shahjahanpur.	1891-92	46	725	379	40,549	41,653	90,854	...	...	...	Spring level at depths from below 10 to 20 feet.
	1892-93	9	734	411	45,226	46,371	114,495	...	...	...	
	1893-94	7	739	318	35,702	36,759	66,135	...	...	...	
	1894-95	10	743	392	20,778	21,913	28,737	...	...	...	
	1895-96										
	1896-97										
	1897-98										
	1898-99										
	1899-1900										
	1900-1901										
	Total, 4 years	72	...	...	...	...	...	...	...	...	
	+ or − in 1894-95 as compared with 1891-92.	...	+18	+13	−19,771	−19,740	−62,117	...	...	...	
Pilibhit.	1891-92	...	2	262	11,707	11,971	24,657	...	...	...	Spring level at depths 10 to 20 feet.
	1892-93	...	1	159	14,841	15,001	32,620	...	...	...	
	1893-94	1	2	92	7,984	8,078	12,915	...	...	...	
	1894-95	...	2	102	6,804	6,908	11,288	...	...	...	
	1895-96	2	4	94	14,979	15,077	32,279	...	...	...	
	1896-97	...	4	126	18,071	18,201	39,657	...	...	...	
	1897-98	...	4	119	17,484	17,607	40,806	...	...	...	
	1898-99	*									
	1899-1900										
	1900-1901										
	Total, 7 years	3	...	...	...	...	...	...	...	...	
	+ or − in 1897-98 as compared with 1891-92.	...	+2	−143	+5,777	+5,636	+16,149	...	...	...	
Cawnpore.	1891-92	396	8,387	1,440	15,375	25,200	95,096	...	...	...	Spring level at depths 10 to 80 feet.
	1892-93	409	8,284	1,441	14,915	24,640	83,261	...	...	...	
	1893-94	330	8,563	1,464	14,583	24,610	63,759	...	...	...	
	1894-95	180	8,645	1,371	8,591	18,607	11,298	...	...	...	
	1895-96	222	8,728	1,369	9,380	19,477	73,583	...	...	...	
	1896-97	411	8,953	1,293	12,723	22,969	102,864	...	...	...	
	1897-98	318	9,160	1,333	13,896	24,389	95,586	...	...	...	
	1898-99	342	9,379	1,343	12,785	23,507	91,143	...	...	...	
	1899-1900	275	9,574	1,315	12,704	23,593	96,158	...	...	...	
	1900-1901	270	9,782	1,322	12,308	23,412	60,384	...	...	...	
	Total	3,153	...	...	...	...	...	...	...	...	
	+ or − in 1900-1901 as compared with 1891-92.	...	+1,395	−118	−3,065	−1,788	−34,712	...	...	...	
Fatehpur.	1891-92	159	12,113	227	6,274	18,614	103,180	...	...	...	Spring level at depths 20 to 80 feet.
	1892-93	144	12,173	205	5,997	18,375	94,506	...	...	...	
	1893-94	148	12,278	239	5,665	18,182	79,374	...	...	...	
	1894-95	79	12,315	176	2,091	14,582	19,279	...	...	...	
	1895-96	78	12,339	152	2,087	14,578	82,285	...	...	...	
	1896-97	136	12,417	171	3,570	16,158	117,951	...	...	...	
	1897-98	178	12,560	170	3,999	16,729	116,384	...	...	...	
	1898-99	216	12,728	147	3,680	16,555	101,405	...	...	...	
	1899-1900	171	12,840	147	3,350	16,337	106,263	...	...	...	
	1900-1901	151	12,954	150	3,083	16,187	79,850	...	...	...	
	Total	1,460	...	...	...	...	...	...	...	...	
	+ or − in 1900-1901 as compared with 1891-92.	...	+841	−77	−3,191	−2,427	−23,330	...	...	...	

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* Figures not available.

Mr. W. H. Moreland.

27th Nov. 02.

Statement showing the number of wells in use for irrigation during each of the past ten years, and cultivated area irrigated by the wells in each year, etc., etc., in each district and province—continued.

District.	Year.	Number of wells. Masonry. Constructed during the year.	Number of wells. Masonry. Total at end of year.	Number of wells. Earthen. Half-masonry.	Number of wells. Earthen. Earthen.	Number of wells. Total of columns 4 and 5.	Area irrigated from wells.	Amount of *takavi* advanced for wells.	Number of wells constructed or repaired by means of *takavi*. Constructed.	Number of wells constructed or repaired by means of *takavi*. Repaired.	Brief note showing average depth to water surface, average cost of each class of wells, average gross area irrigated annually by each, etc.
1	2	3	4	5a	5b	6	7	8	9	10	11
BANDA	1891-92	12	973	231	122	1,326	3,427	...	...	...	Spring level at depths 20 to 60 feet.
	1892-93	2	969	184	85	1,238	3,230	...	...	...	
	1893-94	10	978	173	110	1,261	2,948	...	...	...	
	1894-95	...	976	154	109	1,239	1,655	...	...	...	
	1895-96	1	977	207	107	1,291	3,621	...	...	...	
	1896-97	2	979	208	223	1,410	4,890	...	...	...	
	1897-98	8	980	295	100	1,375	3,674	...	...	...	
	1898-99	3	983	236	135	1,354	3,763	...	...	...	
	1899-1900	16	998	305	176	1,479	4,606	...	...	...	
	1900-1901	1	999	291	158	1,448	3,674	...	...	...	
	Total	55	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+26	+60	+36	+122	+247	...	...	...	
HAMIRPUR.	1891-92	53	8,549	837	1,567	10,953	15,137	...	...	...	Spring level at depths 20 to 60 feet.
	1892-93	58	8,590	797	1,503	10,890	14,925	...	...	...	
	1893-94	89	8,656	853	1,419	10,927	14,279	...	...	...	
	1894-95	87	8,721	688	1,062	10,471	10,648	...	...	...	
	1895-96	265	8,955	834	1,329	11,118	15,874	...	...	...	
	1896-97	177	9,120	977	1,477	11,574	17,500	...	...	...	
	1897-98	147	9,225	954	1,489	11,668	16,127	...	..	...	
	1898-99	222	9,399	904	1,375	11,678	15,421	...	...	...	
	1899-1900	164	9,544	776	1,453	11,773	17,240	...	...	...	
	1900-1901	24	9,550	698	1,342	11,590	16,165	...	...	...	
	Total	1,286	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+1,001	—139	—225	+637	+1,028	...	...	...	
ALLAHABAD.	1891-92	801	14,417	2,477	17,782	34,676	144,760	...	...	...	Spring level at depths 10 to 60 feet.
	1892-93	564	14,856	2,650	17,922	35,428	144,067	...	...	...	
	1893-94	306	15,053	2,803	16,950	34,806	101,086	...	...	...	
	1894-95	221	15,084	2,191	10,424	27,699	95,982	...	...	...	
	1895-96	204	15,182	2,352	11,466	29,000	126,718	...	...	...	
	1896-97	1,222	16,275	2,667	21,607	40,549	199,230	...	...	...	
	1897-98	506	16,709	2,514	18,883	38,106	155,587	...	...	...	
	1898-99	238	16,898	2,658	16,354	35,910	152,570	...	...	...	
	1899-1900	337	17,199	2,659	16,196	36,054	169,223	...	...	...	
	1900-1901	233	17,395	2,712	15,602	35,709	132,064	...	...	...	
	Total	4,632	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+2,978	+235	—2,180	+1,033	—12,696	...	...	...	
JHANSI.	1891-92	*									Spring level at depths 20 to 40 feet.
	1892-93	48	1,742	12,953	2,939	17,634	56,074	...	...	...	
	1893-94	21	1,763	12,410	2,582	16,755	52,600	...	...	...	
	1894-95	*									
	1895-96										
	1896-97										
	1897-98	59	1,833	13,680	2,613	18,026	53,910	...	...	...	
	1898-99	25	1,843	17,057	3,058	21,958	56,450	...	...	...	
	1899-1900	108	1,934	17,964	3,171	23,069	53,108	...	...	...	
	1900-1901	50	1,979	18,509	3,172	23,660	56,332	...	...	...	
	Total, 6 years	311	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1892-93.	...	+237	+5,556	+233	+6,026	+258	...	...	...	

* Figures not available.

Mr. W. H. Moreland.

27th Nov. 02.

Statement showing the number of wells in use for irrigation during each of the past ten years, and cultivated area irrigated by the wells in each year, etc., etc., in each district and province—continued.

District.	Year.	Number of wells.					Area irrigated from wells.	Amount of *takavi* advanced for wells.	Number of wells constructed or repaired by means of *takavi*.		Brief note showing average depth to water surface, average cost of each class of wells, average gross area irrigated annually by each, etc.
		Masonry.		Earthen.		Total of columns 4 and 5.					
		Constructed during the year.	Total at end of year.	Half-masonry.	Earthen.				Constructed.	Repaired.	
1	2	3	4	5a	5b	6	7	8	9	10	11
JALAUN.	1891-92	14	1,091	46	803	1,940	4,910	...	...	...	Spring level at depths 20 to 60 feet.
	1892-93	102	1,023	42	792	1,857	4,273	...	...	...	
	1893-94	186	1,121	76	842	2,039	4,867	...	...	...	
	1894-95	76	993	79	628	1,700	2,839	...	...	...	
	1895-96	74	1,022	84	845	1,951	5,006	...	...	...	
	1896-97	1,719	2,730	110	2,205	5,015	11,867	...	...	...	
	1897-98	45	2,758	117	1,593	4,468	6,815	...	...	...	
	1898-99	69	2,788	104	1,447	4,339	5,688	...	...	...	
	1899-1900	130	2,872	122	1,536	4,530	8,467	...	...	...	
	1900-1901	*									
	Total, 9 years	2,415	...	...	...	...	...	...	...	...	
	+ or — in 1899-1900 as compared with 1891-92.	...	+1,781	+76	+733	+2,590	+3,557	...	...	...	
BENARES.	1891-92	242	8,170	3,064	3,820	15,054	130,930	...	...	...	Spring level at depths 20 to 40 feet (part of the district).
	1892-93	412	8,453	3,133	3,921	15,507	125,218	...	...	...	
	1893-94	126	8,513	3,218	3,502	15,233	105,961	...	...	...	
	1894-95	115	8,515	3,179	2,711	14,405	68,860	...	...	...	
	1895-96	132	8,559	3,234	2,643	14,436	105,164	...	...	...	
	1896-97	101	8,622	3,388	2,906	14,916	125,751	...	...	...	
	1897-98	83	8,672	3,376	2,496	14,544	117,145	...	...	...	
	1898-99	123	8,673	3,750	2,411	14,834	127,494	...	...	...	
	1899-1900	104	8,708	3,694	2,308	14,710	133,169	...	...	...	
	1900-1901	178	8,818	3,615	2,562	14,995	107,408	...	...	...	
	Total	1,619	...	...	...	...	...	..	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+648	+551	—1,258	—59	—23,522	...	...	...	
MIRZAPUR.	1891-92	109	4,661	1,156	4,351	10,168	37,770	...	...	...	Spring level at depths 10 to 60 feet (part of the district).
	1892-93	86	4,590	1,263	4,302	10,155	36,445	...	...	...	
	1893-94	45	4,625	1,525	4,006	10,156	28,238	...	...	...	
	1894-95	24	4,638	1,165	3,240	9,013	16,240	...	...	...	
	1895-96	42	4,676	1,186	3,068	8,930	30,763	...	...	...	
	1896-97	33	4,706	1,177	3,628	9,511	35,294	...	...	...	
	1897-98	24	4,725	908	3,852	9,485	35,855	...	...	...	
	1898-99	26	4,741	1,027	3,459	9,230	37,215	...	...	...	
	1899-1900	7	4,746	1,414	3,244	9,434	38,250	...	...	...	
	1900-1901	...	4,746	1,295	2,496	8,537	22,351	...	...	...	
	Total	346	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+85	+139	—1,855	—1,631	—15,419	...	...	...	
JAUNPUR.	1891-92	374	26,772	772	18,357	45,901	302,576	...	..	...	Spring level at depths 10 to 40 feet.
	1892-93	511	27,172	795	17,787	45,754	306,970	...	...	...	
	1893-94	335	27,356	765	17,397	45,518	274,706	...	...	...	
	1894-95	165	27,423	740	13,294	41,457	152,379	...	...	...	
	1895-96	121	27,465	781	13,119	41,365	269,880	...	...	...	
	1896-97	104	27,564	807	17,027	45,398	343,615	...	...	...	
	1897-98	187	27,689	843	15,639	44,171	291,021	...	...	...	
	1898-99	240	27,880	838	15,037	43,755	307,048	...	...	...	
	1899-1900	148	28,014	1,020	14,122	43,156	318,628	...	...	...	
	1900-1901	76	28,082	1,055	13,522	42,659	285,588	...	...	...	
	Total	2,261	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+1,310	+283	—4,835	—3,242	—16,988	...	...	...	

* Figures not available.

Mr. W. H. Moreland

27th Nov. '02.

Statement showing the number of wells in use for irrigation during each of the past ten years, and cultivated area irrigated by the wells in each year, etc, etc., in each district and province—continued.

		NUMBER OF WELLS.							NUMBER OF WELLS CONSTRUCTED OR REPAIRED BY MEANS OF *takavi*.		
		Masonry.		Earthen.							
District.	Year.	Constructed during the year.	Total at end of year.	Half-masonry.	Earthen.	Total of columns 4 and 5.	Area irrigated from wells.	Amount of *takavi* advanced for wells.	Constructed.	Repaired.	Brief note showing average depth to water surface, average cost of each class of wells, average gross area irrigated annually by each, etc.
1	2	3	4	5*a*	5*b*	6	7	8	9	10	11
GHAZIPUR.	1891-92	34	11,342	13,055	3,759	28,150	179,474	...	...	...	Spring level at depths 10 to 40 feet.
	1892-93	9	11,339	13,242	4,147	28,728	171,254	...	...	...	
	1893-94	20	11,346	13,211	3,882	28,439	155,620	...	...	...	
	1894-95	12	11,339	12,894	2,886	27,119	119,901	...	...	...	
	1895-96	5	11,343	12,256	2,975	26,574	152,817	...	...	...	
	1896-97	10	11,340	13,798	5,085	30,223	174,989	...	...	...	
	1897-98	11	11,346	13,829	3,811	28,986	151,177	...	...	...	
	1898-99	1	11,343	13,850	3,499	28,692	161,138	...	...	...	
	1899-1900	...	11,343	13,861	3,273	28,477	178,539	...	...	...	
	1900-1901	4	11,346	13,094	2,950	27,390	147,194	...	...	...	
	Total	106	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+4	+39	—809	—766	—32,280	...	...	...	
BALLIA.	1891-92	7	493	10,044	6,689	17,226	144,760	...	...	...	Spring level at depths 10 to 40 feet.
	1892-93	103	506	12,104	6,486	19,176	125,474	...	...	...	
	1893-94	59	639	10,279	6,793	17,711	127,363	...	...	...	
	1894-95	21	639	10,002	6,030	16,671	121,098	...	...	...	
	1895-96	9	641	10,602	5,889	17,132	122,548	...	...	...	
	1896-97	3	627	10,355	8,293	19,275	142,528	...	...	...	
	1897-98	12	623	10,461	7,908	18,992	136,133	...	...	...	
	1898-99	6	623	9,700	7,388	17,711	146,900	...	...	...	
	1899-1900	...	623	10,874	6,387	17,884	150,942	...	...	...	
	1900-1901	15	620	10,589	6,464	17,673	133,216	...	...	...	
	Total	235	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+127	+545	—225	+447	—11,544	...	...	...	
GORAKHPUR.	1891-92	141	2,843	26,686	14,591	44,120	251,500	...	...	...	Spring level at depths from below 10 to 20 feet.
	1892-93	81	2,911	27,943	13,630	44,484	240,192	...	...	...	
	1893-94	39	2,934	26,403	12,344	41,681	219,771	...	...	...	
	1894-95	31	2,945	6,128	10,071	19,144	196,563	...	...	...	
	1895-96	113	3,015	6,296	10,462	19,773	214,697	...	...	...	
	1896-97	6,546	9,540	...	36,894	46,434	372,111	...	...	...	
	1897-98	338	9,891	...	20,000	29,891	250,868	...	...	...	
	1898-99	185	10,020	...	16,318	26,338	276,519	...	...	...	
	1899-1900	182	10,158	...	16,928	27,086	304,511	...	...	...	
	1900-1901	110	10,234	...	14,403	24,637	254,362	...	...	...	
	Total	7,816	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+7,391	—26,686	—188	—19,483	+2,862	...	...	...	
BASTI.	1891-92	...	143	24,528	1,368	26,039	179,005	...	...	...	Spring level at depths 10 to 20 feet.
	1892-93	...	143	21,546	1,505	23,194	178,365	...	...	...	
	1893-94	11	140	21,745	1,581	23,466	174,390	...	...	...	
	1894-95	9	135	21,641	1,238	23,014	156,093	...	...	...	
	1895-96	15	137	22,822	1,278	24,237	164,421	...	...	...	
	1896-97	...	136	22,188	10,804	33,128	281,379	...	...	...	
	1897-98	31	163	19,587	3,050	22,800	202,304	...	...	...	
	1898-99	13	173	20,408	2,387	22,968	207,695	...	...	...	
	1899-1900	8	180	19,478	1,998	21,656	213,013	...	...	...	
	1900-1901	...	180	20,290	1,707	22,177	198,996	...	...	...	
	Total	87	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+37	—4,238	+339	—3,862	19,991	...	...	...	

Mr. W. H. Moreland.

27th Nov. 02.

Statement showing the number of wells in use for irrigation during each of the past ten years, and cultivated area irrigated by the wells in each year, etc., etc., in each district and province—continued.

District.	Year.	NUMBER OF WELLS. Masonry. Constructed during the year.	NUMBER OF WELLS. Masonry. Total at end of year.	NUMBER OF WELLS. Earthen. Half-masonry.	NUMBER OF WELLS. Earthen. Earthen.	Total of columns 4 and 5.	Area irrigated from wells.	Amount of *takavi* advanced for wells.	NUMBER OF WELLS CONSTRUCTED OR REPAIRED BY MEANS OF *takavi*. Constructed.	NUMBER OF WELLS CONSTRUCTED OR REPAIRED BY MEANS OF *takavi*. Repaired.	Brief note showing average depth to water surface, average cost of each class of wells, average gross area irrigated annually by each, etc.
1	2	3	4	5a	5b	6	7	8	9	10	11
AZAMGARH.	1891-92	267	29,618	...	5,193	34,811	326,113	...	...	...	Spring level at depths 10 to 40 feet.
	1892-93	372	29,830	6	5,076	34,912	312,787	...	...	...	
	1893-94	196	29,932	6	4,378	34,316	251,137	...	...	...	
	1894-95	149	29,974	...	3,174	33,148	329,057	...	...	...	
	1895-96	68	29,988	25	3,091	33,104	262,556	...	...	...	
	1896-97	114	30,052	12	9,342	39,406	376,812	...	...	...	
	1897-98	171	29,941	37	5,360	35,338	257,897	...	...	...	
	1898-99	*									
	1899-1900										
	1900-1901										
	Total, 7 years	1,337	...	...	...	...	...	...	...	...	
	+ or — in 1897-98 as compared with 1891-92.	...	+323	+37	+167	+527	—68,216	...	...	...	
NAINI TAL.	1891-92	...	8	135	12	155	45	...	...	...	
	1892-93	...	8	146	268	422	67	...	...	...	
	1893-94	1	9	111	269	389	65	...	...	...	
	1894-95	...	9	112	184	305	59	...	...	...	
	1895-96	...	9	11	112	132	62	...	...	...	
	1896-97	...	9	108	188	305	87	...	...	...	
	1897-98	...	9	2	92	103	38	...	...	...	
	1898-99	...	9	2	18	29	56	...	...	...	
	1899-1900	...	9	3	128	140	356	...	...	...	
	1900-1901	...	9	3	53	65	81	...	...	...	
	Total	1	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+1	—132	+41	—90	+36	...	...	...	
LUCKNOW.	1891-92	145	4,141	241	8,345	12,727	54,819	...	...	...	Spring level at depths 20 to 40 feet.
	1892-93	116	4,086	218	8,027	12,331	50,784	...	...	...	
	1893-94	*									
	1894-95										
	1895-96	121	4,032	175	6,835	11,042	46,738	...	...	...	
	1896-97	284	4,242	202	17,140	21,584	95,160	...	...	...	
	1897-98	317	4,426	254	14,496	19,176	87,493	...	...	...	
	1898-99	209	4,532	286	10,533	15,351	61,088	...	...	...	
	1899-1900	348	4,837	318	13,745	18,900	90,639	...	...	...	
	1900-1901	148	4,897	345	10,786	16,028	58,300	...	...	...	
	Total, 8 years	1,688	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+756	+104	+2,441	+3,301	+3,481	...	...	...	
UNAO.	1891-92	*									Spring level at depths 10 to 40 feet.
	1892-93										
	1893-94										
	1894-95										
	1895-96	413	9,103	876	24,488	34,417	105,779	...	...	...	
	1896-97	369	9,400	1,017	55,107	65,524	172,771	...	...	...	
	1897-98	685	9,956	1,005	45,824	56,785	161,503	...	...	...	
	1898-99	362	10,177	1,053	23,228	34,458	131,159	...	...	...	
	1899-1900	227	10,359	1,176	36,042	47,577	147,107	...	...	...	
	1900-1901	292	10,209	941	27,897	39,047	98,167	...	...	...	
	Total, 6 years	2,348	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1895-96.	...	+1,106	+65	+3,459	+4,630	—7,612	...	...	...	

* Figures not available.

Statement showing the number of wells in use for irrigation during each of the past ten years, and cultivated area irrigated by the wells in each year, etc., etc., in each district and province—continued.

District.	Year.	NUMBER OF WELLS.					Area irrigated from wells.	Amount of *takavi* advanced for wells.	NUMBER OF WELLS CONSTRUCTED OR REPAIRED BY MEANS OF *takavi*.		Brief note showing average depth to water surface, average cost of each class of wells, average gross area irrigated annually by each, etc.
		Masonry.		Earthen.		Total of columns 4 and 5.					
		Constructed during the year.	Total at end of year.	Half-masonry.	Earthen.				Constructed.	Repaired.	
1	2	3	4	5a	5b	6	7	8	9	10	11
RAE BARELI.	1891-92	*									Spring level at depths 10 to 40 feet.
	1892-93										
	1893-94										
	1894 95										
	1895-96										
	1896-97	234	18,881	8,474	28,089	55,444	266,111	...	...	...	
	1897-98	779	19,580	6,890	15,116	41,586	215,156	...	...	...	
	1898-99	480	19,934	7,217	10,111	37,262	180,688	...	...	...	
	1899-1900	394	20,217	7,052	10,822	38,091	194,349	...	...	...	
	1900-1901	392	20,508	8,158	10,500	39,166	164,756	...	...	...	
	Total, 5 years	2,279	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1896-97.	...	+1,627	—316	—17,589	—16,278	—101,355	...	...	...	
SITAPUR.	1891-92	9	1,220	41	16,402	17,663	43,204	...	...	...	Spring level at depths 10 to 40 feet.
	1892-93	15	1,235	47	15,341	16,623	38,213	...	...	...	
	1893-94	*									
	1894-95										
	1895-96										
	1896-97	13	1,260	68	27,788	29,116	82,940	...	...	...	
	1897-98	81	1,310	72	32,073	33,485	115,433	...	...	...	
	1898-99	57	1,388	71	21,873	23,332	57,825	...	...	...	
	1899-1900	46	1,432	97	24,686	26,215	98,347	...	...	...	
	1900-1901	68	1,495	54	19,188	20,737	51,661	...	...	...	
	Total, 7 years	289	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+275	+13	+2,786	+3,074	+8,457	...	...	...	
HARDOI.	1891-92	42	1,153	1,949	34,721	37,823	87,870	...	...	...	Spring level at depths 10 to 40 feet.
	1892-93	*									
	1893-94										
	1894-95										
	1895-96										
	1896-97										
	1897-98	7	1,162	3,149	54,273	58,584	162 122	...	...	...	
	1898-99	4	1,166	3,073	45,380	49,619	125,166	...	...	...	
	1899-1900	6	1,172	3,589	65,913	70,674	186,660	...	...	...	
	1900-1901	*									
	Total, 4 years	59	...	...	...	...	...	...	...	...	
	+ or — in 1899-1900 as compared with 1891-92.	...	+19	+1,640	+31,192	+32,851	+98,790	...	...	...	
KHERI.	1891-92	4	390	40	19,635	20,065	41,048	...	...	...	Spring level at depths from below 10 to 20 feet.
	1892-93	13	403	51	19,022	19,476	45,168	...	...	...	
	1893-94	11	414	47	11,897	12,358	22,395	...	...	...	
	1894 95	...	414	41	10,019	10,474	14,048	...	...	...	
	1895-96	*									
	1896 97										
	1897-98										
	1898-99										
	1899-1900	...	414	69	29,076	29,559	84,250	...	...	...	
	1900-1901	...	414	39	19,938	20,391	46,711	...	...	...	
	Total, 6 years	28	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+24	—1	+303	+326	+5,663	...	...	...	

*Figures not available.

Mr. W. H. Moreland.

27th Nov. 02.

Statement showing the number of wells in use for irrigation during each of the past ten years, and cultivated area irrigated by the wells in each year, etc., etc., in each district and province—continued.

District.	Year.	Number of wells.					Area irrigated from wells.	Amount of *takavi* advanced for wells.	Number of wells constructed or repaired by means of *takavi*.		Brief note showing average depth to water surface, average cost of each class of wells, average gross area irrigated annually by each, etc.
		Masonry.		Earthen.		Total of columns 4 and 5.					
		Constructed during the year.	Total at end of year.	Half-masonry.	Earthen.				Constructed.	Repaired.	
1	2	3	4	5a	5b	6	7	8	9	10	11
FYZABAD.	1891-92	21	784	20,021	2,077	22,882	172,422	...	...	...	Spring level at depths 10 to 20 feet.
	1892-93	13	788	21,770	2,324	24,882	165,595	...	...	...	
	1893-94	*									
	1894-95										
	1895-96	4	795	21,665	1,542	24,002	142,010	...	...	...	
	1896-97	58	844	24,280	7,426	32,550	261,756	...	...	...	
	1897-98	104	921	25,032	3,939	29,892	178,981	...	...	...	
	1898-99	162	1,045	24,490	2,813	28,348	173,122	...	...	...	
	1899-1900	71	1,103	25,828	2,462	29,393	188,497	...	...	...	
	1900-1901	119	1,185	26,175	2,165	29,525	171,397	...	...	...	
	Total, 8 years	552	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+401	+6,154	+88	+6,643	—1,025	...	...	...	
GONDA.	1891-92	...	305	13,035	11,481	24,821	153,501	...	...	...	Spring level at depths from below 10 to 20 feet.
	1892-93	...	305	12,719	11,887	24,911	143,662	...	...	...	
	1893-94	...	305	11,494	7,148	18,947	126,458	...	...	...	
	1894-95	7	309	10,870	5,836	17,015	81,163	...	...	...	
	1895-96	1	305	12,021	7,816	20,142	106,992	...	...	...	
	1896-97	1	305	14,401	20,423	35,129	149,742	...	...	...	
	1897-98	*									
	1898-99										
	1899-1900										
	1900-1901										
	Total, 6 years	9	...	...	...	...	...	...	...	...	
	+ or — in 1896-97 as compared with 1891-92.	...	...	+1,366	+8,942	+10,308	—3,759	...	...	...	
BAHRAICH.	1891-92	8	531	1,046	6,914	8,491	18,723	...	...	...	Spring level at depths 10 to 20 feet.
	1892-93	14	545	927	6,156	7,628	17,848	...	...	...	
	1893-94	...	545	796	4,540	5,881	11,960	...	...	...	
	1894-95										
	1895-96										
	1896-97										
	1897-98										
	1898-99										
	1899-1900	15	564	1,520	13,792	15,876	41,569	...	...	...	
	1900-1901	...	564	1,189	4,332	6,085	15,894	...	...	...	
	Total, 5 years	37	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+33	+143	−2,582	—2,406	—2,829	...	...	...	
SULTANPUR.	1891-92	116	13,846	136	8,827	22,309	138,752	...	...	...	Spring level at depths 20 to 60 feet.
	1892-93	*									
	1893-94										
	1894-95										
	1895-96										
	1896-97										
	1897-98										
	1898-99	73	14,366	788	8,093	23,247	164,028	...	...	...	
	1899-1900	103	14,431	794	8,072	23,297	159,705	...	...	...	
	1900-1901	153	14,474	821	7,043	22,338	139,662	...	...	...	
	Total, 4 years	445	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+628	+685	—1,284	+29	+910	...	...	...	

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* Figures not available.

Mr W H Morebana.

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Statement showing the number of wells in use for irrigation during each of the past ten years, and cultivated area irrigated by the wells in each year, etc., etc., in each district and province— continued.

District.	Year.	Number of wells.					Area irrigated from wells.	Amount of *takavi* advanced for wells.	Number of wells constructed or repaired by means of *takavi*.		Brief note showing average depth to water surface, average cost of each class of wells, average gross area irrigated usually by each, etc.
		Masonry.		Earthen.		Total of columns 4 and 5.					
		Constructed during the year.	Total at end of year.	Half-masonry.	Earthen.				Constructed.	Repaired.	
1	2	3	4	5a	5b	6	7	8	9	10	11
Partabgarh.	1891-92	*									Spring level at depths 10 to 40 feet.
	1892-93										
	1893-94										
	1894-95	71	12,779	191	4,621	17,591	†43,510	...	...	...	
	1895-96	95	12,838	198	8,048	21,084	147,913	...	...	...	
	1896-97	237	13,035	273	19,314	32,622	218,489	...	...	...	
	1897-98	422	13,411	225	15,409	29,015	177,355	...	...	...	
	1898-99	309	13,672	206	12,736	26,614	175,830	...	...	...	
	1899-1900	279	13,890	260	11,800	25,950	173,329	...	...	...	
	1900-1901	273	14,001	258	10,948	25,207	153,914	...	...	...	
	Total, 7 years	1,686	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1894-95.	...	+1,222	+67	+6,327	+7,616	+110,404	...	...	...	
Baba Banki.	1891-92	214	5,968	259	17,632	23,859	76,993	...	...	...	Spring level at depths 20 to 60 feet.
	1892-93	*									
	1893-94										
	1894-95										
	1895-96										
	1896-97										
	1897-98	328	6,491	265	28,765	35,521	138,092	...	...	...	
	1898-99	160	6,491	212	20,781	27,484	89,493	...	...	...	
	1899-1900	199	6,472	195	23,081	29,748	131,843	...	...	...	
	1900-1901	172	6,431	222	19,024	25,677	94,525	...	...	...	
	Total, 5 years	1,073	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+463	—37	+1,392	+1,818	+17,532	...	...	...	
Province of Agra.	1891-92	4,488	215.615	124,918	483,135	823,668	3,836,873	...	...	...	
	1892-93	4,442	216.653	123,147	479,582	819,382	3,631,296	...	...	...	
	1893-94	3,631	218,343	119,393	429,664	767,400	3,255,195	...	...	...	
	1894-95	2,384	218,622	97,238	354,788	670.648	1,994,111	...	...	...	
	1895-96	2.887	220,155	100,144	423,317	743,616	3,370,870	...	...	...	
	1896-97	12,639	231,434	97,828	591,078	920,340	4,600,057	...	...	...	
	1897-98	3,918	233,883	95,601	535,405	864,889	3,820,307	...	...	...	
	1898-99	3,105	235.569	101.223	493,558	830,350	3,829,315	...	...	...	
	1899-1900	2,912	237,674	103,088	600,150	940.912	4,478,507	...	...	...	
	1900-1901	2,356	239,094	103,095	449,956	792,145	3,286,546	...	...	...	
	Total	42,762	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+23,479	—21,823	—33,179	—31,523	—550,327	...	...	...	
Oudh.	1891-92	860	68,511	38,155	178,118	284,784	1,217,497	...	...	...	
	1892-93	540	68,734	39,795	167,914	276,443	1,213,476	...	...	...	
	1893-94	284	68,742	38,366	136,404	243.512	1,092,741	...	...	...	
	1894-95	283	68,785	37,352	108,619	214.756	863,184	...	...	...	
	1895-96	797	69,294	43,823	122,030	235,147	1,054,828	...	...	...	
	1896-97	1,347	70.311	52.251	252,027	374,589	1,715,809	...	...	...	
	1897-98	3,094	72,860	53,585	258,441	384,886	1,592,513	...	...	...	
	1898-99	1,816	74.039	53,115	193,735	320,889	1,353,572	...	...	...	
	1899-1900	1,688	75,196	55,488	258,838	389,522	1,643,178	...	...	...	
	1900-1901	1,624	75,661	55,604	192,922	324,187	1,257,383	...	...	...	
	Total	12,333	...	...	...	...	...	...	...	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+7,150	+17,449	+14,804	+39,403	+39,886	...	...	...	

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* Figures not available.
† Excessive rainfall.

Mr. W. H. Moreland.

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Statement showing the number of wells in use for irrigation during each of the past ten years, and cultivated area irrigated by the wells in each year, etc., etc., in each district and province—concluded.

Provincial (both Agra and Oudh).

District.	Year.	Number of wells. Masonry. Constructed during the year.	Number of wells. Masonry. Total at the end of year.	Number of wells. Earthen. Half-masonry.	Number of wells. Earthen. Earthen.	Total of columns 4 and 5.	Area irrigated from wells.	Amount of *takavi* advanced for wells.	Number of wells constructed or repaired by means of *takavi*. Constructed.	Number of wells constructed or repaired by means of *takavi*. Repaired.	Brief note showing average depth to water surface, average cost of each class of wells, average gross area irrigated annually by each, etc.
1	2	3	4	5a	5b	6	7	8	9	10	11
United Provinces of Agra and Oudh.	1891-92	5,348	284,126	163,073	661,253	1,108,452	5,054,370	...	...	...	
	1892-93	4,982	285,387	162,942	647,496	1,095 825	4,844,772	...	...	...	
	1893-94	3,915	287,085	157,759	566,068	1,010,912	4,347,936	...	...	...	
	1894-95	2,667	287,407	134,590	463,407	885,404	2,857,295	...	...	...	
	1895-96	3,684	289,449	143,967	545,347	978,763	4,425,698	...	...	...	
	1896-97	13,986	301,745	150,079	843,105	1,294,929	6,315,866	...	...	...	
	1897-98	7,012	306,743	149,186	793,846	1,249,775	5,412,820	...	...	...	
	1898-99	4,921	309,608	154,338	687,293	1,151,239	5,182,887	...	...	...	
	1899-1900	4,600	312,870	158,576	858,988	1,330,434	6,121,685	...	...	...	
	1900-1901	3,980	314,755	158,699	642,878	1,116,332	4,543,929	...	...	...	
	Total	55,095	...	...	...	...	...	...	.	...	
	+ or — in 1900-1901 as compared with 1891-92.	...	+30,629	—4,374	+18,375	+7,880	—510,441	...	...	...	

NOTE—In order to compile the Provincial total, figures have been assumed for the districts from which returns were not received.

Average area irrigated per well.—The attached statement shows the average area irrigated per well in 1893-94, which is taken as a fairly normal year, and in three dry years—the famine year, 1896-97, the dry year, 1899-1900, and last year when the winter rains were so deficient. The blanks indicate years when statistics were not prepared.

Statement showing the cultivated area irrigated per well in a specified normal year (1893-94) and in three years of drought.

Division.	District.	1301 Fasli (1893-94), normal year. Total number of wells.	1301 Fasli (1893-94), normal year. Total (cultivated) area irrigated from wells.	1301 Fasli (1893-94), normal year. Area irrigated per well.	1304 Fasli (1896-97), year of drought. Total number of wells.	1304 Fasli (1896-97), year of drought. Total (cultivated) area irrigated from wells.	1304 Fasli (1896-97), year of drought. Area irrigated per well.	1307 Fasli (1899-1900), year of drought. Total number of wells.	1307 Fasli (1899-1900), year of drought. Total (cultivated) area irrigated from wells.	1307 Fasli (1899-1900), year of drought. Area irrigated per well.	1309 Fasli (1901-1902), year of drought. Total number of wells.	1309 Fasli (1901-1902), year of drought. Total (cultivated) area irrigated from wells.	1309 Fasli (1901-1902), year of drought. Area irrigated per well.
	Province of Agra.												
Meerut.	Dehra Dun	44	3	·06	40	31	1	45	17	0·4	41	18	0·4
	Saharanpur	5,773	28,705	5	6,719	55,572	8	7,599	72,787	10	7,080	51,550	7
	Muzaffarnagar	8,610	63,891	7	8,934	102,086	11	13,463	116,068	9	9,429	89,731	10
	Meerut	17,455	118,406	7	...	...	...	...	...	...	18,242	202,806	11
	Bulandshahr	14,576	118,595	8	15,874	193,522	12	18,139	232,094	13	18,896	207,596	12
	Aligarh	38,605	291,306	8	43,623	368,450	8	...	...	...	...	...	...
Agra.	Muttra	35,680	138,741	4	37,898	181,826	5	37,352	166,816	4	38,368	155,788	4
	Agra	66,541	199,243	3	72,633	260,835	4	72,269	238,811	3	73,635	224,164	3
	Farrukhabad	39,005	99,743	3	56,902	175,081	3	...	...	...	...	...	...
	Mainpuri	27,542	148,155	5	34,184	205,848	6	...	...	...	...	...	...
	Etawah	13,339	43,546	3	16,699	78,771	5	...	...	...	18,120	64,743	4
	Etah	27,158	135,177	5	42,932	200,443	5	...	...	...	...	...	...
Rohilkhand.	Bareilly	22,569	25,373	1	...	...	...	...	...	...	...	...	...
	Bijnor	4,070	4,039	1	...	...	..	...	...	...	...	...	...
	Budaun	40,599	65,460	2	...	...	...	99,184	197,630	2	65,886	108,966	2
	Moradabad	35,508	39,603	1	63,073	89,865	1	87,643	188,363	2	34,466	49,860	1
	Shahjahanpur	36,759	66,135	2	...	...	...	...	...	...	...	...	...
	Pilibhit	8,078	12,915	2	18,201	39,657	2	...	...	...	...	...	...
Allahabad.	Cawnpore	24,610	63,759	3	22,969	102,864	4	23,593	96,158	4	25,309	88,478	3
	Fatehpur	18,182	79,374	4	16,158	117,951	7	16,337	106,263	7	16,484	91,193	6
	Banda	1,261	2,943	2	1,410	4,890	3	1,479	4,606	3	1,421	3,815	3
	Hamirpur	10,927	14,279	1	11,574	17,500	2	11,773	17,240	1	11,541	15,621	1
	Allahabad	34,806	101,086	3	40,549	199,230	5	36,054	169,223	5	36,149	150,850	4
	Jhansi	16,755	52,600	3	...	...	...	23,069	53,108	2	23,637	59,553	3
	Jalaun	2,039	4,867	2	5,015	11,867	2	4,530	8,467	2	...	...	...

Statement showing the cultivated area irrigated per well in a specified normal year (1893-94) and in three years of drought—continued.

Division.	District.	1301 FASLI (1893-94), NORMAL YEAR.			1304 FASLI (1896-97), YEAR OF DROUGHT.			1307 FASLI (1899-1900), YEAR OF DROUGHT.			1309 FASLI (1900-1902), YEAR OF DROUGHT.		
		Total number of wells.	Total (cultivated) area irrigated from wells.	Area irrigated per well.	Total number of wells.	Total (cultivated) area irrigated from wells.	Area irrigated per well.	Total number of wells.	Total (cultivated) area irrigated from wells.	Area irrigated per well.	Total number of wells.	Total (cultivated) area irrigated from wells.	Area irrigated per well.
BENARES.	Benares	15,233	105,961	7	14,916	125,751	8	14,710	133,169	9	14,227	133,995	9
	Mirzapur	10,156	28,238	3	9,511	35,294	4	9,434	38,250	4	8,926	34,195	4
	Jaunpur	45,518	274,706	6	45,398	343,615	8	43,156	318,628	7	43,214	326,147	8
	Ghazipur	28,439	155,620	5	30,223	174,989	6	28,477	178,539	6	29,936	191,096	6
	Ballia	17,711	127,363	7	19,275	142,528	7	17,884	150,942	8	18,824	156,579	8
GORAKHPUR.	Gorakhpur	41,681	219,771	5	46,434	372,111	8	27,086	304,511	11	27,438	322,023	11
	Basti	23,466	174,390	7	33,128	281,379	8	21,656	213,013	10	22,715	231,352	10
	Azamgarh	34,316	251,137	7	39,406	376,812	10	...	...	...	...	...	...
KUMAUN.	Naini Tal	389	65	0·2	305	87	0·2	140	356	3	104	120	1
	OUDH.												
LUCKNOW.	Lucknow	11,024	41,556	4	21,584	95,160	4	18,900	90,639	5	15,765	70,097	4
	Unao	33,930	102,984	3	65,524	172,771	3	47,577	147,107	3	45,669	137,807	3
	Rae Bareli	31,400	170,958	5	55,444	266,111	5	38,091	194,349	5	42,767	193,217	5
	Sitapur	16,331	34,807	2	29,116	82,940	3	26,215	98,347	4	31,561	78,704	2
	Hardoi	17,964	72,962	4	..	...	...	70,674	186,660	3	...	...	...
	Kheri	12,358	22,395	2	...	...	...	29,559	84,250	3	17,437	43,702	3
FYZABAD.	Fyzabad	24,280	151,294	6	32,550	261,756	8	29,393	188,497	6	30,824	218,098	7
	Gonda	18,947	126,458	7	85,129	149,742	4	...	...	...	...	...	...
	Bahraich	5,881	11,960	2	...	...	...	15,876	41,569	3	10,803	27,423	3
	Sultanpur	22,614	147,367	7	...	...	...	23,297	159,705	7	23,759	170,400	7
	Partabgarh	27,279	143,397	5	32,622	218,489	7	25,950	173,329	7	27,233	182,243	6
	Bara Banki	21,504	66,603	3	...	...	...	29,748	121,843	4	29,746	111,320	4

NOTE.—The areas shown in this statement do not include double cropped area.

Districts in which the extension or security of cultivation must depend mainly on the construction of new wells.—This includes practically the whole of the provinces, except Bundelkhand, in a large portion of which the construction of wells is a doubtful question; and a tract in Muttra, Aligarh, and Etah, where the quantity of salts contained in the water makes many wells useless, especially in seasons of drought. In large areas, however, where cheap, unprotected wells are efficient, the question hardly arises; these areas have not, however, as yet been defined with precision.

The above remarks assume that the supplies of water now drawn from the Ganges and Jumna cannot be increased to an appreciable extent.

Paragraph 9. Private irrigation works other than wells.—Field embankments are employed to a greater or less extent universally throughout the provinces, except in parts of Bundelkhand and Mirzapur, and in the worst sand. The ordinary form of field boundary is a bank of earth, perhaps a foot broad and varying in height from a few inches to a foot or more. These are used for regulating the amount of rain water that stays on the field. In rice lands the boundaries are higher and broader, and merge by degrees into regular embankments capable of holding up a considerable amount of water. Beyond these, again, come the large *bandhs*, which are often to be seen in the rice districts, consisting of a ramp of earth thrown across a depression and holding up the flood water. Similarly, the smaller streams are often bunded in the cold weather to hold up enough water for irrigating the *rabi*.

In none of these cases does it seem necessary to offer encouragement beyond what is afforded by the *takavi* system.

Larger works are very few in number, so far as my information goes. There is a small system of indigenous canals in the east of pargana Usehat of the Budaun district, by which the water of the Sot river is used to irrigate rich tracts of rice land. A fuller description of these can be seen in the handbook of pargana Usehat. I understand that some of the European planters in the Gorakhpur Division have constructed dams on a considerable scale for the irrigation of their land; further information regarding these may, perhaps, be available in the Board's office.

Paragraph 10. Black cotton soil.—I can find no records of the depth of these soils or of the underlying strata. Consequently, I can give no information on the subjects noted in this paragraph. Nor can I give any figures to show the increase of produce secured by irrigation on black soils, as the crop-cutting statements received do not give the name of the soil on which the crop was grown.

1. *Q.* (*The President.*)—You have an expert well-sinker attached to the department. Do you find much work for him?—He was only appointed a year ago and hitherto he has had more than he can do.

2. *Q.* Has he trained any others under him?—He has subordinates to do boring, but he is not at present training any school of engineers in special work. My intention is that, if the demand for his services continue, we shall get a young overseer to be trained by him as his assistant.

3. *Q.* (*Mr. Muir-Mackenzie.*)—He is a Public Works man?—Yes; he was working on bridge building. Then he had a special training at Roorkee. I mean to wait on the demand.

4. *Q.* (*The President.*)—Would it not be a good thing to start some others as soon as possible?—I cannot say that the demand is not temporary. This man has been lent to examine the drinking wells in the Terai. He is now going down to the south of Mirzapur to try some of the rock wells. I cannot say whether there is work for one man or five.

5. *Q.* It seems very important that well-sinkers should get advice of this sort. We have had a great deal of evidence in the different districts of the trouble that arises from mistakes in sinking wells; and there has been a proposal that at the head-quarters of each district there should be boring tools available. That was tried by our department in 1884. I cannot find where those boring tools are now; perhaps in the District Engineer's godown. I should object to leaving tools about if there is no man to look after them.

6. *Q.* Do you know how much the tools cost?—A set costs about Rs. 300.

Mr. W. H. Moreland.

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7. *Q.* Can you not get them cheaper?—With the system of boring, under which we work at present with iron pipes, that is the cheapest we can get them for. But the Deputy Director of my department, who has had American experience, says that it can be done much cheaper at any rate to 30 or 40 feet, with an ordinary augur, without the pipes, and we are working out the details of that. In that case it would not cost more than Rs. 150 at the outside.

8. *Q.* We have been struck in our evidence of Oudh with the immense number of wells. In the Rae Bareli district there is one for every 30 acres. Is there any limit to that? When will they begin to interfere with one another?—We have not reached the limit yet. I have been working out the districts that have the largest number of wells. Fyzabad had 22½ wells to every square mile in 1897, Pachhim Rathi. There was no complaint of the wells running dry. It is a dampish district. Barabanki—Hyderganj—had 17.

9. *Q.* Are these mostly recent or old?—The increase goes on steadily. The wet years, which ended in 1894, seem to have had the effect of diminishing the rate, but we have not got the figures for the 80's. In the beginning of 1896 there was a rapid extension, which again shows signs of a falling off.

10. *Q.* Do you think that this natural extension of well is enough that we should try to stimulate it by giving greater facilities for *takavi* loans?—The latter are not much availed of apparently,—not as much as they might be. I think the delay in getting the loan is the thing the people most object to.

11. *Q.* If there were some simple, easy procedure for giving loans, more might be taken?—I do not say it would make any very great difference, but it would be an aid to the people.

12. *Q.* So far, I think, our Commission must come to this conclusion about Oudh; that wells and *jhil* (tank) irrigation is the only mode of irrigation they are likely to have. Public opinion seems to be very strong against any great canal scheme. Public opinion was very much against it in Barabanki.

13. *Q.* Therefore there is the more reason to encourage them to extend *pakka* wells?—It must depend on *pakka* wells putting aside the Sardah Canal.

14. *Q.* What is your opinion as to the area commanded by a well in ordinary circumstances?—I do not think it possible to give an estimate for the Provinces: the 1,309 well-irrigated area last cold weather showed that in some cases 8 acres were irrigated; in others 7.

✓15. *Q.* Have you experience of a canal-irrigated district?—I have been all through the centre of the Agra Division, and I have been Collector of Bulandshahr.

✓16. *Q.* Twenty years ago there was a strong feeling on the part of revenue officers of the mischief done by over-irrigation, and we were encouraged to keep irrigation down to about 30 per cent. of the actual village lands. From our enquiries at Allahabad it seems that that feeling has passed away and that a village may have 80 per cent. of village lands irrigated without any harm. The theory was before that, do what you like. The land became water-logged, *reh* came to the surface, and it was feared that the low-lying lands would be injured?—It depends entirely on the circumstances of the individual village. If you have a village or a large area of fertile low land, it may be very unsafe to irrigate 25 per cent of it. But with a village with very little low land, it would be perfect—safe to go to 40 per cent. in any single year; that would be 60 or 70 per cent. allowing for rotation.

17. *Q.* Is there any chance of the villagers reducing their grazing grounds for the sake of getting irrigated crops?—There is practically no grazing ground in irrigated districts now.

18. *Q.* That is very serious; is it not?—It is serious in a way, but it is a question of turning the available land to the best advantage.

✓19. *Q.* Have you known of a case of land which had become water-logged or covered with *reh* being restored to cultivation by drainage?—I have seen no case. But the Kalinadi valley in the Bulandshahr district has large areas cultivated which used to be covered by *reh* before the channel was deepened. In the Unao district in the year 1893-94 when I was doing settlement the villages along the Sai river were completely water-logged and had to have their revenue reduced in some cases by one-half. The low lands were covered with *reh*. That is all under cultivation again now.

✓20. *Q.* There was no drainage work?—No drainage was done. That was a case of the stream being unable to do its drainage work in the wet seasons. It was the series of wet years in 1891-1894, which started our calamities.

21. *Q.* Have you a difficulty in *kans* grass in Bundelkhand?—I know nothing special about that. I have an experiment just being planned, but it is not far enough on to say anything about it.

22 *Q.* Have you seen irrigation at all on black cotton soil?—Rarely.

23. *Q.* You have heard the general opinion expressed that irrigation is not suitable for that soil?—Yes.

24. *Q.* Do you think the feeling is general throughout Oudh against the Sardah Canal?—So far as I have had an opportunity of judging.

25. *Q.* Does your own judgment go along with the general opinion?—I am not very sure about the alignment; but so far as it goes into Barabanki, which I know, it would be very nearly useless, and it would certainly interfere with the existing well system.

26. *Q.* Would the result not be that men would give up their wells and take to it. In the beginning of the irrigation of the Doab irrigation was deliberately taken into the well tracts, because it was thought that people understood irrigation and would take to it, and of course the wells were given up enormously. We did not come to the same thing here in Oudh?—I think the Oudh cultivator is more likely to stick to his well than the North-Western. He is a harder worker.

27. *Q.* He is a wiser man than his brother across the Ganges?—I certainly think he is, but perhaps I am prejudiced in his favour.

28. *Q.* (*Mr. Muir-Mackenzie.*)—As to the number of wells, we have been given by Mr. Hooper and Mr. Butler statistics saying that wells have enormously increased in certain districts of Oudh since the last settlement and your figures do not agree with those. Mr. Butler gives us 7,609 wells in Hardoi and your figures only, say, 1,100 *pakka* wells?—My figures are those returned by the local records staff for the statistics of the Government of India. They come from the district officers.

29. *Q.* Which are right?—Perhaps the Settlement Officer of Hardoi may be able to explain it. The classification of half-masonry and masonry wells is always doubtful. But even if you take the half-masonry wells from what Mr. Hooper gives, that would come to 600. Are there any other deficiencies?—Possibly Mr. Hooper included wells for the supply of drinking water.

30. *Q.* No, Mr. Butler was most careful to speak of *pakka* wells only?—At the last settlement wells in village sites used only for drinking water were not enumerated separately from wells used for irrigation. The village accountant sends the figures to the circle officer, who checks 7 per cent. and a certain amount is checked by superior officers too.

31. *Q.* Is the latter check complete?—It is not.

32. *Q.* I suppose the district officers have not much time to do it?—There is always some other special work every year and the ordinary work has to go.

33. *Q.* How many *kanungos* to a *tahsil*?—There is 1 to about 45 *patwaris*, so there will be 3 *kanungos* in a *tahsil*, or 4 or 5, as the case may be.

34. *Q.* But even if the check is not as full as you would like it to be, that would not account for the very large discrepancy?—Unless there had been some mistake of compilation in the district officer's.

35. *Q.* May we take it that the life of a masonry well is infinitely long?—There is a very steady disappearance of masonry wells. I do not think you can say that they are quite permanent.

36. *Q.* Does the *kachcha-pakka* well last as long as the *pakka*?—Not in ordinary cases; the *kachcha-pakka* well is the cheaper expedient.

37. *Q.* How much does it cost?—I have been told that it costs a half to two-thirds of a *pakka* well of the same size, but that is a very general estimate.

38. *Q.* Is it enough to make it worth while to make advances for it?—I think so. If a cultivator wants to make a permanent well, he makes a *pakka* well. A *kachcha-pakka* well is the cheaper expedient in place of a *pakka* and a *kachcha* well is the first expedient.

39. *Q.* As to areas irrigated you cannot give separate details for *kachcha* and *pakka*?—It depends on many features; the strength of the cattle and the size of the bucket affect it.

40. *Q.* Mr. Gillon told us 50 *bighas* were irrigated from one *pakka* well in Meerut?—That must be with big cattle.

41. *Q.* The Court of Wards man from Aligarh told us 50 acres for a six-bucket well. The size of the cattle will not account for that difference?—No. I think, if you look at the

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figures, you will see that I am not justified in giving any average. In districts lying side by side the difference varies from 3 to 8 acres. Eventually we put it at about 8 or 9 acres. That is one of the conventions of the statistics of the Government of India.

42. *Q.* For settlement purposes?—The officer sees how much each well is doing. He has to allow for the improvement for each individual well. The settlement statistics are the ordinary statistics prepared with a little additional care.

43. *Q.* Is not that additional care an important matter in that case?—I think it is. My own personal test of papers in the last four years showed the error comes to 5 or 6 per cent., and the settlement might reduce it to 3 per cent.

44. *Q.* Presuming that there has been a large increase of wells since the last settlement, when did it occur?—I cannot tell you what time they were made—before 1890.

45. *Q.* With regard to the increase in the famine year, would a cultivator ordinarily have time to get a *pakka* well built in order to be of use to him in a famine year?—I think the wells were hurried up. There is plenty of labour to be had, and a good many wells were used when they were quite incomplete.

46. *Q.* This rather negatives the view, which has never been mine, that it is no good to make advances for *pakka* wells in famine years. Were you Director at the time of the famine?—Temporary Director for six months.

47. *Q.* I suppose you are opposed to the idea of Government constructing wells?—The experience in the Moradabad district was distinctly against it.

48. *Q.* Still has it not been the case that with the Court of Wards a certain amount of success has been obtained?—The success has been greatest when the Court of Wards has given the tenants all the help they could and left them to make the wells.

49. *Q.* I am ready to admit that, but can you say that the other course has not been successful on the Court of Wards? Does not a good manager succeed?—A good manager succeeds. My feelings are no doubt rather coloured by the great number of useless wells I have seen built by the Court of Wards in one district. What I feel about Government management is that the advantage of Government taking up any work gets smaller as the work gets smaller.

50. *Q.* But it might be better to try Government work than nothing at all in places where people are backward?—I would always much prefer to advance the money to any people who would take it up.

51. *Q.* And if the people are backward?—If the people are too backward to make wells, they will be too backward to use them.

52. *Q.* Even when the well is put down in the place and its usefulness is shown before their eyes?—I do not know of any such case in these provinces.

53. *Q.* Mr. Molony has recommended to us a general sort of survey of the levels of the *mota*, to map out the general *mota* tract; do you agree?—Colonel Clibborn made an outline map of the distribution of the *mota*. It might be worth while to survey villages lying along the edge of the *mota* as shown in the outline.

54. *Q.* Would it be unsafe to push advances until a survey had been made?—I should not put off advances.

55. *Q.* Would you have this sort of work—survey of *mota* and the investigating of conditions favourable to well-sinking—all left with the present agency?—The way to work it would be for two or three experts when they have time to work out a dozen villages or so at a time.

56. *Q.* So far as it affects irrigation, could it not be entrusted to the Irrigation Department?—They have not officers on the spot.

57. *Q.* They would have to have them?—They are more competent to do it than anyone else.

58. *Q.* Do you think that a staff is wanted?—I doubt if there is room in these provinces.

59. *Q.* I do not agree with it. What is the reason that the people give for their objection to canal irrigation in Oudh?—They say that it will raise the water level, depreciate the low lands and affect the health of the district, and they do not want any more Government subordinates than they can help.

60. *Q.* You allude to the area of the Kalinadi as an instance of the beneficial effect of drainage in decreasing *reh*. Do you know any instance in which drainage has had the opposite effect,—the effect of so lowering the water level that lands have gone out of cultivation?—I have had a report of the west of Aligarh district to the effect that the water level had sunk so low that the wells could not be used for irrigation. I have not seen any case myself.

61. *Q.* It has been suggested that drains should all have regulators, so that besides being of use in a wet year they would hold up water in a dry year by shutting up the outlet of the drain and keeping the water in?—It would be a very useful thing if it could be done without friction; but it would be likely to lead to a good deal of friction between owners along the different parts of its length. I put that before the Irrigation Department in 1896.

62. *Q.* What became of the suggestion?—I do not know.

63 *Q.* (*Sir Thomas Higham.*)—It has been suggested that something might be done for the Hardoi district by making an inundation canal, taking it at a high point of the Sardah?—I do not know the Hardoi district personally.

64 *Q.* The idea is that it would be of use in filling up the *jhils* in a very dry year. It would not give a regular irrigation supply like a permanent canal?—I really do not know enough about the district to give an opinion of any value.

65. *Q.* (*Mr. Rajaratna Mudaliar.*)—Is any great technical knowledge required for using boring instruments?—Not very much, but practice.

66. *Q.* I suppose your overseer would be able to train a sufficient number of people?—Quite easily.

67. *Q.* Does the area irrigated per well represent the area commanded or the area actually irrigated?—The area actually irrigated in one year.

68. *Q.* The Honourable Mr. Palmer has given us a statement of weather figures. He says he has consulted you on the subject. Would the statement afford reliable data for taking action? It is a sort of scarcity barometer?—It is a thing you would have to use with a great deal of care.

69. *Q.* (*Mr. Muir-Mackenzie.*)—Am I correct in understanding that there was no very great failure of the *rabi* in 1896-97?—The *rabi* that was sown was a good crop. Some crops were damaged; gram suffered a good deal.

70. *Q.* There is not much experience of any extensive failure of *rabi*?—No, the areas sown were small, but that is a different thing.

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WITNESS No. 18.—MR. M. NETHERSOLE, Executive Engineer, Northern Division, Ganges Canal, Roorkee.

Office Memo. No. C.-1212-I., dated Camp, the 5th November 1902.

From—C. G. HALL, Esq., *Under-Secy. to Govt., United Provinces of Agra and Oudh, P. W. D., I. B.,*

To—Chief Secretary to Government, United Provinces of Agra and Oudh.

In continuaion of this Office Memorandum No. C.-1175-I., dated 23rd October 1902, the Under-Secretary is directed to forward, in original, a note, dated 3rd November 1902, by Mr. M. Nethersole, Executive Engineer, Northern Division, Ganges Canal, on recent improvements in the distributary system, as required by paragraphs 3 and 4 of the Memoramdum of points to be considered by the Irrigation Commission.

Note, dated 3rd November 1902, on recent Improvements in the Distributary System.

My practical experience of irrigation in these provinces from 1881—1893 was acquired principally in the Anupshahr, Meerut, and Etawah Divisions and on the Dun Canals; but my duties as Personal Assistant to the Superintending Engineer, II Circle, and afterwards when reorganizing the Traffic Department, gave me a superficial acquaintance with every division in the I and II Circles.

From 1893—1900 I was absent from the Provinces on deputation, and on my return I was in a position to notice changes in irrigation practice which had occurred in the provinces during my absence. The most noteable and far-reaching change was the abolition of internal *tatils* on distributary systems. When I left it was exceptional for any distributary of any size to run except with internal

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tatils of outlets; in other words, the capacity of the distributaries was not equal to the total outlet discharge.

On my return I found this system abolished. Distributaries had been remodelled and their capacity increased on the basis of the outlet requirements, and the system of alternate running of distributaries had replaced the old *tatils.*

Outlets had at the same time been revised and re-distributed, the areas to be irrigated from each having been demarcated on special *shajra* sheets prepared for each distributary system.

Redundant outlets had been removed, and in many cases the longer village water-courses had been replaced by Government minors. Another change I noticed was a general reduction in distributary bed slopes, and the interpolation of extra falls, thereby admitting of a more detailed attention to command, resulting in many places in the conversion of lift irriagtion into flow.

And, finally, considerable extensions of the drainage systems had been effected, resulting in an extended area suitable for superior crops.

The benefits resulting from these improvements may be classed as follows:—

(*a*) reduction of waste both on Government channels and in village water-courses.

(*b*) greater elasticity of irrigating power affording better protection to larger areas;

(*c*) more efficient maintenance following on increased opportunities for repairs to channels;

(*d*) more efficient supervision and check of irrigation following on the freeing of superior establishment from the very arduous criminal work which was inseparable from the old *tatil* system;

(*e*) direct encouragement to irrigation, for the abolition of *tatil* can only be compared to the abolition of a direct tax on trade in its beneficial results to cultivators.

The results of the improvements in my division may be traced in the following figures, taken from revenue reports, which compare four years of more or less similar meteorological conditions:—

Northern Division, Ganges Canal.

Years.	Area irrigated in acres.			Total of daily discharges.			Depth of water used.				Remarks.
	Kharif.	Rabi.	Total.	Kharif.	Rabi.	Total.	Kharif.	Rabi.	Total.	Sugar areas.	
1883-84 .	47,541	60,354	107,895	107,651	88,510	196,161	4·53	2·10	2·98	23·692	Drought.
1896-97 .	55,422	64,253	119,675	86,238	84,025	170,266	3·11	1·74	2·25	31·596	
1899-1900	72,415	93,472	165,887	122,462	107,638	230,100	3·38	1·63	2·52	38·222	
1901-1902	69,017	87,524	156,541	107,903	87,746	195,649	3·12	1·55	2·15	25·242*	

* Area actually sown was 139,000 acres, but it was reduced by failure of crop due to grasshoppers.

Comparing the results of 1883-84 and 1901-1902, it will be seen that, while the distributary consumption was practically identical, in the two years the area irrigated in 1900-1901 was no less than

$$\frac{156{,}541-107{,}895}{1{,}079}$$

= 45 per cent. better than in 1883-84.

Further evidence of improvement is afforded by the results of this last *kharif* (which I have just received from the office) as compared with the year of record area (1307 *fasli*):—

	Kharif area in acres.	*Revenue.* Rs.
1307 . . .	75,370	4,36,905
1310 . . .	70,375	4,32,427
Total .	—4,995	—4,478

While the area is nearly 5,000 acres less, the revenue is only Rs. 4,478 less, showing a large proportion of first class crops and possibly also (for I have not the analysis of the totals before me) a better ratio of flow to lift.

Undoubtedly a large share in their good results is fairly attributable to the improvements in system which I have noted above.

There is one marked point of difference, however, which, in my opinion, can only be regarded as a comparative defect, and that is the short-handedness of the department in the Assistant Engineer's grade. When I left the province, it was the general rule for each division to have two European Assistant Engineers, who generally held their subdivisions for two or three years.

Since my return I find that many divisions have no European Assistants at all, and personally I have been much hampered in my work by constant changes of Subdivisional Officers. This is a defect which, in my opinion, cannot fail to militate against steady progress, and I note it for what it is worth.

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1. *Q.* (*The President*).—You have had large experience in the irrigation of the Doab?—Yes.

2. *Q.* You have given us a very interesting note upon the economies which have been effected by the abolition of internal *tatils* or distributary systems. By this reduction of slope, which you allude to, what has the result been upon the silting of the distributaries?—On the whole, I think, there is less trouble with silt now than there used to be.

3. *Q.* Is there a lot of heavy deposit at the head of the distributary?—The head of the distributary is kept at a steeper slope for the first mile, or mile-and-a-half, or two miles. It is below that these flatter slopes have been introduced.

4. *Q.* Have you made any experiment in the direction of puddling?—We have just been asked to make some, but we are not really in a position to make any experiments with regard to puddling water-courses unless we know exactly what the water-course is discharging, and that is an exceedingly difficult thing to arrive at. A very valuable step in that direction has been taken by a note published by Lala Chote Lal. He has given us a parabolic notch for observing a small discharge. By taking the levels up and down stream you get accurate discharges of even the smallest water-course, and when you have got that, you will be in a position to continue experiments with regard to puddling. My personal opinion is, you won't do much in puddling.

5. *Q.* Have you done anything in regard to puddling distributaries themselves?—Yes. The silt you rely on to puddle your distributaries has considerable adhesion, and the flat bed slopes generally adopted quickly promote a good impermeable term.

6. *Q.* Do you consider the whole of the silt is dropped in the first mile or so?—No. It is carried right over to the tails. It goes chiefly into the *gools* owing to increased velocity through the Colaba pipe?—A steady velocity seems to be able to carry on silt almost indefinitely.

7. *Q.* Even the heavy silt?—We get no really heavy silt in the Ganges Canal; it is all fine stuff. You get shingle deposits at the head; they don't go below Jamalpur Bridge.

8. *Q.* Surely there is a great deal of sand deposit?—Yes, but it is light sand, not heavy sand by any means,—not the sand that makes mortar.

9. *Q.* It goes to the bottom sooner than alluvial matter?—Yes, certainly.

10. *Q.* Have you been in the Northern Division, Ganges Canal, since 1900?—No. I was in the Rohilkhand Division for rather less than a year.

11. *Q.* You have hardly had time in the Northern Division to estimate the economy of water that has been produced by those results ?—I have to a certain extent on a few channels, and generally I have statistics which I should think could give you any information on that subject you might require, going over a range of years.

12. *Q.* What I want to get at is what you are doing with the water that is economised ?—Part of that has already gone down to the Cawnpore-Fatehpur extension and part will go to the Mat Branch extension. I think, if you had held to the *tatil* system, you could not have got either of these extensions.

13. *Q.* You are really working in the Northern Division with less water than there used to be ?—You are not using less water, but you are getting a very much larger area. I say in the paragraph following the table I have prepared in my notes :—"Comparing the results of 1883-84 and 1901-02, it will be seen that, while the distributary consumption was practically identical in the two years, the area irrigated in 1900-1901 was no less than $\frac{156,541-107,895}{1,079}$ = 45 per cent. better than in 1883-84." There is a very large economy there.

14. *Q.* Where is that water going ? Is it going to lengthening the distributaries, or giving closer irrigation to the villages already irrigated ?—There has been very little lengthening of channels. I have a list of villages with statistics, the average for five years ending 1893-94, and the maximum area irrigated in any one year. It is tabulated and I have compared that with what we are doing now. The maximum area irrigated in acres since this table was made out is 177,000, whereas previous to this the maximum area irrigated in any year was 116,000 acres, showing an excess of 60,000 acres, or 52 per cent. over our previous maximum. The number of villages is practically identical, so this shows that there has been closer irrigation in villages.

15. *Q.* Whereabouts is your maximum irrigation about Muzaffarnagar ?—Yes, that is the heaviest.

16. *Q.* As an irrigation officer, what limit do you see to this ? Are you going to irrigate cent. per cent. ?—Personally I should be against that.

17. *Q.* Have you got about as high as you can get ?—The percentage of area irrigated on the total area commanded is 39 per cent., and the percentage of area irrigated on the cultivated area commanded is 49 per cent.

18. *Q.* Then you think you have probably got to about as far as should be the limit ?—Yes, but I think there are still openings for small minors, but there is no urgency about them. We might do one or two every year for some little time.

19. *Q.* It would be better then in general for the future,—more economical I mean,—in the interests of the whole country to pass on more water ?—I certainly think so. I think there is certainly a limit and that limit has been laid down several times and been as often overlooked.

20. *Q.* Thirty years ago there was considerable talk about an Eastern Ganges Canal and there were various reasons gvien for not carrying it out. One chief reason was that the Lower Ganges Canal was being worked at high pressure, and there was no water for a third canal. Do you think it would be a good policy throughout the Ganges Canal where the Northern Division has now got a higher irrigation than the other divisions to look into this question again of having an Eastern Ganges Canal with the savings this system has produced ?—I do not think it would be a safe policy in view of the minimum supply in the river. We have had such very low discharges in the Ganges, so much lower than ever estimated by Cautley who estimated a minimum discharge at Hardwar at 8,000, and we have had it down to 4,400 at the most critical time of the year ; that is a great risk. Besides, with all these extensions, we are going on extending our responsibility on the existing system.

21. *Q.* When you got down to 4,400, was that one of these drought years ?—That was, I think, in March 1892.

22. *Q.* That was not a drought year ; was it ?—It was a year of excessive rainfall, but of course that occurred before the rainfall.

23. *Q.* You allude in your note to a very important matter, namely, the shorthandedness in the department in the Assistant Engineer's grade. You say—"when I left the province, it was the general rule for each division to have two European Assistant Engineers, who generally held their subdivisions for two or three years. Since my return I find that many divisions have no European Assistants at all, and personally I have been much hampered in my work by constant changes of subdivisional officers." Of your assistants, are they generally Cooper's Hill men or generally Roorkee men ?—There are very few Cooper's Hill men Assistant Engineers in the department at all.

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24. *Q.* Do you know what the reason of that is ?—I think that when I was in the department before the Canal Branch was looked upon as the better of the two, "Roads and Buildings," was regarded as below notice. Since then I find there has been a great revulsion of feeling and many men now actually prefer the formerly despised department, because it is more comfortable.

25. *Q.* Is the promotion fast in the other departments ?—I should imagine they get responsible positions for instance, being put in charge of districts sooner than we do in the canals. They have a much easier life of it too.

26. *Q.* Do you consider one of the reasons for this revulsion of feeling is that there is less constructive work in the Canals Department ?—Undoubtedly construction is always attractive to all engineers. Then again it is a very lonely life in the canals, especially in the hot weather, and there is a lot of routine about canals which every man cannot take to.

27. *Q.* (*Sir Thomas Higham.*)—I see from this statement of yours that the maximum area irrigated in this division up to the year 1893-94 was about one-third, or 33 per cent. of the cultivated area that was commanded ?—It is about one-third.

28. *Q.* Within the last seven years you have carried out improvements which have enabled you with about the same quantity of water to raise that proportion from one-third to one-half ?—Yes, but I cannot say that the whole of that increase is due to our improvements. There is what you may call a normal increase going on always.

29. *Q.* The point is that the area has been increased from 33 per cent. to 50 per cent. ?—Yes.

30. *Q.* By this canal all the villages were very fully protected when you irrigated one-third of your cultivated area ?—Taking the average, certainly.

31. *Q.* There was no question of famine in the canal villages ?—No, I think not.

32. *Q.* Do not you think it would be better, with whatever water you saved, instead of going in to the same old villages if you might extend the area of irrigation ?—I think it is too late in the day to consider that now ; it should have been considered sooner.

33. *Q.* But this increase has occurred within the last seven years ; it is not of very long standing ?—It would lead to very great trouble if it were at all tampered with now.

34. *Q.* Are there areas to which you could extend it ?—There are a few villages right in the middle of my division which are not touched by the canal.

35. *Q.* Do they require irrigation ?—Yes ; they would like it. Four or five villages between the Imliya Kala and the Kalinuddi have been left out in the cold. I have a minor under project to relieve them. They have suffered in the dry years. There are other minor areas.

36. *Q.* Surely you could bring those minor areas under command by reducing your existing irrigation to 48 per cent.—Yes, I think we could do it. In fact, in my division I think, we could manage it without reduction.

37. *Q.* Are you making new minors that will bring these tracts under irrigation ?—Yes.

38. *Q.* Is there any regular scheme for it ?—I have a list which we are working gradually through.

39. *Q.* You say that it will cause great dissatisfaction if you were to reduce the area of the present villages. I suppose it is possible you may get a still further improvement ?—Yes.

40. *Q.* Where is the water you have saved to go to ?—The Mat Branch extension will want a great deal. I think that will absorb all our economies for some time to come.

41. *Q.* Are you looking forward to seeing an increase in your existing villages ?—I do not want to make any increase there.

42. *Q.* They get as much water as they ought to have ?—Yes, I think so.

43. *Q.* You have given us some figures here showing the reduction in the general depth of water spread over the land since 1894 ?—That is only another way of showing the economy. It is the same thing differently expressed.

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44. *Q.* You show there has been a reduction from 2·98 to 2·15, or, roughly speaking, from a depth of three feet over the whole area to a depth of two feet?—Yes.

45. *Q.* That all depends on the total daily discharges of course?—Yes.

46. *Q.* Is your record of daily discharges now fairly comparable with those of 1884?—I am not able to tell you that. I should imagine they are better looked after now than they used to be. They are checked oftener by actual discharges and the alteration of standard table discharge for distributaries is looked after better now.

47. *Q.* The figures are for the Northern Division?—Yes.

48. *Q.* How do you determine the discharges of the distributaries?—We have *pakka* discharge sites on each distributary and daily gauges are read.

49. *Q.* And how often are the actual discharges taken?—Once a month. They are often taken oftener. The Subdivisional Officer is supposed to take the discharge once a month.

50. *Q.* And then does he make out the monthly table of discharges?—They come up to me and I make any alterations that are necessary.

51. *Q.* What do you compare them with?—I have tabulated discharges for each distributary. Supposing the discharge has been taken for a gauge of 3·5 and it works out to 60 cusecs, if my tabulated discharge for that gauge is within 10 per cent. of that, I make no alteration; if the difference is higher, I issue alterations.

52. *Q.* Are the total discharges of the distributaries compared at all with the main canal?—Only by the Chief Engineer for the whole canal. It is not done for our division specially.

53. *Q.* Does each Divisional Officer do it himself?—It is shown in the return sent by me to the Chief Engineer.

54. *Q.* You have to show the quantity of water you use in your division?—Yes.

55. *Q.* You never compare that with the actual discharge of your distributaries?—I do not for any purpose of taking out irrigation figures.

56. *Q.* My point is this. I want to know how far you can rely on the discharges of your distributaries as being fairly correct?—It is very much more accurate than the other.

57. *Q.* (*The President.*)—Than the canal?—Yes.

58. *Q.* (*Sir Thomas Higham.*)—Anyhow you consider that the distributary discharges in 1884 were nothing like so accurately determined as now?—I do not think I should be ready to say so. I should say it may be so. I think the discharges generally are better looked after lately, than they used to be.

59. *Q.* Was the system of monthly discharges in force 20 years ago?—I think not; not to the same extent.

60. *Q.* Do you think that is a reliable conclusion that has been arrived at, *viz.*, that instead of putting three feet of water on the whole area, you have only but two feet?—Figures are always capable of being questioned; they are accurate so far as they can be obtained.

61. *Q.* Are all the minors in the Northern Division carried to the borders all over the village?—No.

62. *Q.* Do many villages take their water-courses through intervening villages?—Yes.

63. *Q.* So that villages share a water-course, or does each have a separate one?—As a rule they share in such cases.

64. *Q.* That is to say, two or more villages get irrigation from one water-course?—Yes.

65. *Q.* Is there much of that?—A good deal.

66. *Q.* Do you ever have much difficulty about that?—Occasionally.

67. *Q.* What do you consider would be about the average length of the water-courses?—I should say we have very few longer than ¾ of a mile in a direct line; but the other day I checked the total length of water-courses to one mile of distributary taken haphazard. The lateral command on each side of the distributary was only three furlongs, and yet in that mile there was no less than 8½ miles of cultivators' *gools*.

68. *Q.* I understand you to say there are no Assistant Engineers now, because everybody prefers to go to the General Branch?—That is not the only reason why we are shorthanded. They say they are shorthanded too.

69. *Q.* If your men were to go to them, they would get over their strength?—I do not know; I have never gone into that question. I have felt the want of Assistant Engineers myself, and I see a difference to what there used to be before.

70. *Q.* Before you went away there used to be two Assistants to each division; now there is only one?—Very often none.

71. *Q.* When did you go away?—In 1893, but I was very nearly two years on furlough before that, so that I practically left in 1891.

72. *Q.* Since that the proportion of Executives to Assistants has been very much increased; has it not?—I believe so.

73. *Q.* Instead of having two Assistants to one Executive the strength of the department is such as to give one and one. Does not that cover the whole thing?—That does not help us so far as the point I have raised is concerned. An Executive still holds the same division as he used to do when he had two Assistants and now he has only one.

74. *Q.* Do you think every Executive should have two Assistants?—I think so.

75. *Q.* That means that everybody's promotion would be delayed greatly?—That is for you to correct.

76. *Q.* Was it not the case before 1893 that every Assistant Engineer had to serve about 15 years before he got a division?—I personally was an Assistant Engineer about 14 years. I got my promotion, if I remember rightly, in 1894.

77. *Q.* They do not serve so long as that now?—No.

78. *Q.* (*The President.*)—Have you ever made any experiments in artificially puddling distributaries?—We have been ordered to make them now; but, as I say, you cannot begin that until you have some method of measuring the discharge of your water-course.

79. *Q.* I was thinking of a big distributary?—It is the only way that could be done. I would prefer to take up a minor rather than a big distributary; it is a very big job.

80. *Q.* (*Mr. Rajaratna Mudaliar.*)—Do you grant remissions when water is not taken?—We never charge when water is not taken.

81. *Q.* We were told the other day by a witness, Mr. Shivanath Sinha, that no remission is granted when water is not taken. That is not the case in your division; is it?—No; certainly not.

82. *Q.* The measurement and assessment of canal areas is done by a special staff under your supervision; is it not?—Yes.

83. *Q.* Do you see any objection to that work being transferred to the Revenue Department? I might mention that that is the case in Madras. You would be relieved of petty details if that were done?—I do not see how you could very well separate the two. You would have to alter entirely our method of working.

84. *Q.* But the distribution will still rest with you. It is simply the measurement and assessment which will be done by the Revenue Department, and they can send you daily or weekly reports?—My personal feeling is that it is better not to transfer it. I think that a canal officer is very much more about his work than any revenue officer could possibly be. Our engineering work obliges us to go about actually on the canals themselves and see the irrigation, and I have far better opportunities of getting in touch with the irrigators than a revenue officer could possibly have, unless you made a special branch of the Revenue Department to deal with the matter, in which case you would be introducing quite a considerable increase in the establishment unnecessarily. If you tried to do it now with your ordinary Revenue Department, and handed over our measuring staff to the Revenue Department, there could not possibly be the same supervision by the superior revenue establishment, as we can give it with our superior canal establishment.

85. *Q.* Could it be done without enhancement of expenditure?—It could be done without enhancement of expenditure, but what I say is that a revenue officer could not supervise that establishment so efficiently as our Executive Engineers and Subdivisional Officers now do, simply because our work in the engineering line obliges us to be on the spot, and we can do it concurrently with our other duties, whereas a Collector has a lot of other works to attend to, and often has to be at head-quarters. There could not be the same personal supervision without a large increase of establishment. That is the chief objection; otherwise there is no great objection to it.

86. *Q.* Do the Executive Engineers at present check the measurements of the patrols?—Yes, a great deal.

(*Mr. Rajaratna Mudaliar.*)—This is what Colonel Strachey wrote in 1869 on the subject:—"Taken, as a whole, the present system is, in my opinion, very excellent in most respects, though I consider that it carries the canal engineers too far into the details of fiscal management which could be as well cared for by persons not having technical engineering knowledge. But the present adjustment of the line to be drawn between the province of the engineer and the revenue officer is obviously one of those matters on which it is impossible to dogmatise with advantage." So he thought that far too much of the time of the engineering officers is taken up with details of fiscal management.

(*The President.*)—In those days canal officers not only assessed but collected the revenue. That is stopped now that irrigation has practically settled down.

87. *Q.* (*Mr. Rajaratna Mudaliar.*)—You do not think any advantage would be gained by the change I suggest?—No; no advantage.

88. *Q.* (*Sir Thomas Higham.*)—In your division do they have an owner's rate levied?—There is very little levied since the last settlement. It is about Rs. 5,000 a year for the whole division.

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89. *Q.* (*Mr. Roberts.*)—With reference to what Mr. Rajaratna Mudaliar was asking about changing the system of assessment and measurement in canal areas, the present system works smoothly enough; does it not?—There is no friction between the revenue authorities and the canal authorities?—No. Personally I have found the revenue authorities most easy to deal with in all canal matters. There is no friction at all.

90. *Q.* You take the assistance of *patwaris* in making your canal *jamabandis*?—Yes. Technically he is supposed always to be with our *amin* when he is measuring; practically he is not always there. He does help us to a certain extent.

91. *Q.* Do troubles arise in regard to the amin's entries and the *patwari's* entries in the village papers?—Sometimes. A case happened quite recently where a *patwari* was not present at measurement and a tenant who had been dispossessed by civil suit was improperly reinstated by my *amin*. The petty Magistrate who tried the case went entirely on my *amin's* measurements, but I sent the case to the Collector and had it corrected. Such cases, however, are very rare.

92. *Q.* What pay does an *amin* get?—He begins with Rs. 14 and ends at Rs. 25.

93. *Q.* He is a better paid man than the *patwari*?—He is a capable man; not an ordinary measurer.

WITNESS NO. 19.—MR. J. H. COX, Deputy Commissioner of Hardoi.

Mr. J. H. Cox.

27th Nov. 02

1. *Q.* (*The President.*)—You are Deputy Commissioner of Hardoi?—I am at present revising the settlement; I have been Deputy Commissioner.

2. *Q.* Supposing the old scheme of the Sardah Canal blotted out and in place of that a *kharif* canal of moderate dimensions brought in with a view of giving irrigation in the month of October and filling up *jhils*, especially as regards Hardoi district, assuming that it might be done for a reasonable sum, what do you think of it?—I have never heard the matter suggested.

3. *Q.* Sir James himself started it, I think?—A suggestion which occurs to me is that it would be impracticable to afford protection to the district, as the scheme would not touch the *bhur* tracts, which most need irrigation, while it would benefit the tracts which in ordinary years get a fair amount of tank irrigation. It would be of little use in an ordinary year, but useful in a year of drought.

4. *Q.* (*Sir Thomas Higham.*)—The idea is that in ordinary years it would not work at all?—That does not touch the engineering question of the raising of the water-level.

5. *Q.* (*The President.*)—It would not touch the *bhur*?—There are *jhils* in the *bhur* tract.

6. *Q.* Is there much rice grown in the Hardoi district?—It is not a heavy rice-growing district.

7. *Q.* In how many years would that sort of canal be useful?—Within my own experience it would have been of use in the two famine years of 1895-96 and 1899, when there was a premature cessation of the rains; and it would have been a certain amount of use this year when the later rains were not of as much use as they might have been. It would not have been of any good in the four years preceding 1895.

8. *Q.* Perhaps it might have given a first watering over *rabi* lands in October?—If you are going to have direct irrigation distributaries and could get the canal to a high enough level, you could benefit the *bhur* tracts, but most of the *bhur* land is rather high.

9. *Q.* Your district is very copiously irrigated by wells?

10. *Q.* (*Mr. Roberts.*)—Are you preparing further well statistics?—No; we are re-classifying the soils.

11. *Q.* (*The President.*)—Were you controlling during the season 1896-97?—No; I went there early in 1898.

12. *Q.* During a dry year the *jhil* irrigation would run down very low?—It is found to fail almost entirely.

13. *Q.* On the other hand, wells, I suppose, practically do not fail?—No; the average well duty is a trifle more in a year of extreme drought; and in a year of moderate drought, for instance, 1899, they managed to make a lot more wells and got rather a high average out of them.

14. *Q.* Can you say how much is well and how much is *jhil* irrigation?—Roughly speaking, well irrigation and *jhil* irrigation are in the proportion of 6 to 5.

15. *Q.* Assuming a season of prolonged drought in which you can no longer trust to the *jhils*, would the well irrigation pull the district through?—Under the existing well irrigation. It did not in the famine.

16. *Q.* Therefore, when one can do nothing to raise the *jhil* irrigation to any great extent, it becomes the more necessary to encourage the making of wells?—Yes.

17. *Q.* And they can be increased to such an extent as to make the district protected?—No; I do not think that that is possible, because there are so many tracts in which the *kachcha* well is impracticable. The *pakka* well can be sunk, but the people cannot be got to sink them in sufficient number; the cost is so high. The proprietors are generally small men.

18. *Q.* Could the Government lend them money on any more favourable terms to increase the number of *pakka* wells?—I should be very chary of doing much for some time to come, though the people took considerable advances in time of famine. They were told they would be expected to pay, but they got it into their heads that they would not be expected to repay. Subsequently they were required to repay and look upon that as rather a grievance. They took a lot more money than they needed, under the impression that repayment would not be required. I have reason to believe that in some cases they took Rs. 500. They took Rs. 500 and spent Rs. 100 on *shadi* and the other Rs. 400 on wells. Now they are chary of taking advances.

19. *Q.* From the point of view of this Commission, which is famine protection, it seems to be such an exceedingly important thing that one would be glad to look anywhere for any means of making it more popular if advances are repayable in six or seven years?—My impression is that they go on longer than that.

20. *Q.* Supposing it were made 20 years?—Perhaps that would popularise it.

21. *Q.* In the south, if a man makes a *pakka* well, his land is assessed as dry for all future time. Here it is only to the end of the next settlement?—Yes.

22. *Q.* Should that change be encouraged?—I doubt if they look so far forward as that.

23. *Q.* We have heard complaints throughout all India that a good deal of money sticks in the hands of the *amla* while passing through; that there are vexatious delays, and this man and that man to be bribed and arranged with. Is there any means of getting rid of that?—I do not think so. I found out some time ago that there was no doubt that a revenue accountant had been taking money from each man who had an advance for a well. It was not a case that could be judicially proved, but I was morally sure of the man's guilt. The exaction was not regarded as a grievance by the recipients of *takavi*.

24. *Q.* Is there any way of getting round that kind of thing?—I have not been able to discover it.

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25. *Q.* Does the rayat take *takavi* advances, or is it always the zamindar?—The rayat takes it freely.

26. *Q.* Would a zamindar object to the rayat's making *pakka* wells?—I have come across very few cases of objections being raised; the zamindar generally has very adequate reasons for objecting.

27. *Q.* What line of policy would you suggest to render Hardoi district more immune in time of famine than it is now? I mean measures that irrigation can do?—Beyond endeavouring to increase the number of wells I have not been able to think of anything.

28. *Q.* (*Mr. Muir-Mackenzie.*)—Can you solve this question of the apparent discrepancy that there is between the figures given as to the increase in the number of wells during settlement?—No. The figures I have got show very little increase. They come to about 900 or a thousand *pakka* wells, and there is very little increase since the previous settlement. My figures were compiled in the district office.

29. *Q.* Where did Mr. Butler get his figures? Did he get them from Mr. Davis?—I suppose he got them from Mr. Davis.

30. *Q.* Mr. Butler also seemed to assume that in Oudh generally, and he made no exception as regards Hardoi, wells were largely made by the tenants?—Speaking from my own knowledge, I should have said the majority were made by zamindars. Those made with advances from Government are certainly nearly all made by zamindars, generally cultivating zamindars.

31. *Q.* In the areas, which you have to take into account for the purposes of your settlement, you surely have to know whether they are made by zamindars or tenants?—I have not been very much concerned with that, because Mr. Davis had already made the necessary allowances for wells, although I have been concerned with making allowance for wells made between Mr. Davis's settlement and my own settlement. The total allowances conceded for wells was about Rs. 4,000.

32. *Q.* What would they come to, Rs. 50 per well?—Roughly speaking, about Rs. 25 a well, I should think.

33. *Q.* Do you think the conditions of your tenure or of the land law of Oudh are an obstacle to tenants undertaking the construction of wells?—I do not think so.

34. *Q.* (*Mr. Rajaratna Mudaliar.*)—On what data do you work out your abatement on account of private improvements?—I allow the difference between the wet and dry rates on the area actually irrigated from the wells in either of the two years preceding inspection.

35. *Q.* What is the difference between the two rates?—It varies from as much as about Rs. 2-8 to as little as about eight annas according to soil and situation. The average real difference is about a rupee or twelve annas an acre, I believe.

36. *Q.* You take that and allow an abatement for the period of the next settlement?—Yes.

37. *Q.* And where the difference is not much?—Whatever difference is worked out is allowed. In any case the principle is that the land would have been treated as dry, but for the existence of the well, and the well being there, one continues to treat it as dry.

38. *Q.* Is the cost of the well taken into account?—No.

39. *Q.* Is the abatement granted even in the case of temporary wells?—No, not for *kachcha* wells.

40. *Q.* Only in the case of *pakka* wells?—Yes.

41. *Q.* In Hardoi there are only about eleven hundred and odd *pakka* wells. So probably the concessions granted must be very limited?—Yes. They are about Rs. 3,000 in two tahsils.

42. *Q.* The number of *kachcha* wells is very considerable, from 54,000 to 65,000?—About that it would be, I believe.

43. *Q.* What is the difficulty in converting these into *pakka* wells? Is the cost prohibitive?—They are altogether a different thing. The *kachcha* well is a small well capable of irrigating on the average about an acre per annum, of very small circumference and very little depth; the *pakka* well is capable of irrigating in a year from 8 to 25 acres; has a very much larger circumference and is of considerable depth.

44. *Q.* What is the average cost of a *pakka* well?—Rs. 425. I have had statistics given me in which the cost varies from Rs. 250 to Rs. 500.

45. *Q.* Does not the fact that for a period of 45 years there will be exemption from payment of wet rates which would give stimulus for sinking more *pakka* wells?—That is a question I cannot answer, because we have had no particular opportunity of seeing what would have happened without that stimulus.

46. *Q.* In settlement what do you take as the area irrigated?—Any field which, during two years preceding inspection, has actually been irrigated.

47. *Q.* Two years or three years?—Two years. You get your figures correct from two years, the rotation of crops being that water is applied to irrigable land only in alternate years.

48. *Q.* The area actually irrigated in any two years preceding inspection is, for the purpose of valuation treated as the irrigable area, and that consequently is the area which is deducted in the case of wells. But supposing one field was irrigated in one year, and another in another, how would you arrange?—You combine the total areas. If two fields of an acre each are irrigated, one in one year and the other in the next, your wet area is two acres. If the same field is irrigated twice, your wet area remains one acre.

49. *Q.* Do not you think that by your system you give concession to a larger area than you should?—I think I give it to the correct area. The nearest approach to the correct irrigated area is obtained by taking the fields irrigated in two successive years.

50. *Q.* Would it not be more correct to take the average of the two?—I do not think so.

51. *Q.* The double area cannot be irrigated any one year?—It does not need irrigation in any one year. To put the thing in simple form, say, this paper (shown) represents a village. This half (indicates) is grown with *kharif* this year. That does not need irrigation. This half (indicates) is grown with *rabi*; that does need irrigation. The following year the *rabi* is sown here where the *kharif* was last year; this part needs irrigation. The *kharif* is sown here; that does not need irrigation. Then you have to take the two years together to determine the total area irrigated.

52. *Q.* That would be true for both years, but in any particular year the total of the two plots could not be irrigated?—No, it could not be, and it would not need to be. It would be only if they are used to irrigating the *kharif*.

53. *Q.* (*The President.*)—Would not your basis be that land would obtain a higher price in the market, because it was commanded by a well?—I do not know about commanding a higher price. It is safer.

54. *Q.* And therefore it is more valuable?—It is the safety that one assesses.

55. *Q.* (*Mr. Roberts.*)—Your assessment is based on the rental assessed on an estimated rate?—Corrected by an estimated rate.

56. *Q.* Then in a village, of which half is cultivated with *rabi* one year and half with *kharif*, the whole pays the same wet rate, because in alternate years the whole village receives irrigation?—Yes.

57. *Q.* The only object is to ascertain what is subject to a wet rate?—Yes.

58. *Q.* For that purpose your statistics of the irrigable area are in order to ascertain the area subject to the higher rate of rent?—Yes.

59. *Q.* (*Mr. Muir-Mackenzie.*)—You say the area which in any year can be irrigated, but you only irrigate that village one year, and not two?—The point is that it could be irrigated. It does not want irrigation, because the *kharif* grown in it every alternate year does not want irrigation.

60. *Q.* (*Mr. Roberts.*)—The main classification in Hardoi is the *bhur* and *domat*?—Yes.

61. *Q.* What is the relative proportion for that, do you know?—It varies a great deal. I have got it for two tahsils. I have not got it for the two other tahsils. In the Sandila tahsil it is about one-third of the total area; in the Hardoi tahsil it is about one-fourth of the total area. It is rather a larger proportion in the Shahabad tahsil and a rather lower proportion in Bilgram.

62. *Q.* In the *bhur* tract is there any irrigation at all?—Extremely little. Here are the statistics. In the Hardoi tahsil the *domat* is 94,000 acres wet to 60,000 acres dry, or 3 to 2; the *bhur* 16,000 acres wet to 39,000 acres dry, or roughly 2 to 5.

63. *Q.* Is the *bhur* irrigated to any extent from *pakka* wells?—Not very much.

64. *Q.* A *kachcha* well in the *bhur* tract irrigates less area than a *kachcha* well in the *domat*?—Distinctly.

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65. *Q.* And they are also apt to run dry?—I have never heard any complaints of their running dry except in famine years.

66. *Q.* So that the only scheme for extending irrigation in *bhur* land would be masonry wells?—I think so.

67. *Q.* Can they be built there and at what expense?—I think they can be built in most *bhur* villages; they cannot be built everywhere. There is generally some tract in the village where several wells can be sunk.

68. *Q.* It would be a greater advantage to multiply *pakka* wells in *bhur* land than in the *domat*?—Yes.

69. *Q.* In contrasting zamindars and tenants there is a distinction to be made; is there not, for zamindars? In Hardoi are there not many small zamindars, cultivating zamindars?—Yes, *pattadars*.

70. *Q.* The men who take advances for wells are usually cultivating zamindars, or large landowners?—The men who take advances are, what you may call, fairly substantial *pattadars*—men who pay a revenue of Rs. 100 a year.

71. *Q.* Is the well built for irrigating their own cultivation, or the tenants'?—Sometimes both. A big proprietor does not get advances, as a rule. A taluqdar would not condescend to ask for an advance, and would not get it if he did, because he could afford to do without.

72. *Q.* (*Mr. Rajaratna Mudaliar.*)—In your settlement you do not grant any documents to tenants showing the abatements granted on account of improvements?—No.

(*Mr. Roberts*).—Abatement is on land revenue, not on the rent. On whatever rent the tenant pays to the landlord in both Oudh and the United Provinces the assessment is made.

(*Mr. Rajaratna Mudaliar.*)—In any part of the United Provinces is any abatement given to the tenant on account of improvements by his landlord?

(*Mr. Roberts.*)—Not by the Government. Indirectly he gets it from the Government, because the landlord pays a smaller revenue.

(*Witness.*)—The landlord cannot enhance a tenant's rent on the ground that a tenant has made a well.

(*Mr. Rajaratna Mudaliar.*)—Except in Oudh, occupancy tenants do get abatement; at any rate their rent is not enhanced.

(*Mr. Roberts.*)—Their rent cannot be enhanced on the ground that they have made a well.

EIGHTEENTH DAY.

Lucknow, 28th November 1902.

WITNESS No. 20.—RAJA TASSADDUQ RASUL KHAN, Taluqdar, Jahangirabad, Bara Banki.

Raja Tassadduq Rasul Khan.

28th Nov. 02.

(*To the President.*)—I own lands in Sitapur, Lucknow, and Barabanki. I consider that the existing physical advantages of natural tanks and streams and the facilities for digging wells are sufficient. Well water is much better for the crops than canal water, which spoils the lands, as it brings sand into clay lands which now are very fertile, and which would then become unfertile. I flood my lands which are sandy along the Gumti, and which only grow barley. In the famine year I dug *kachcha* wells for my wheat and got 20 maunds per *bigha*,—a heavier crop than had been obtained by me for 20 years. In districts where canals are already existing no doubt the price of land has risen. I know the Hardoi district. I do not think there will be any benefit from a canal there. Perhaps in 20 or 30 years in the month of October there might be some scarcity of water, but all our requirements could be met from wells. I think *pakka* wells should be increased and there is room for increase. Where zamindars are poor, Government *takavi* advances are useful, provided the whole advance gets to the recipient. Each district should have an expert to decide where wells can be dug. The present fee of Rs. 10 charged by the expert at Cawnpore is too big. In my districts a *kachcha* well costs Rs. 3 to dig and a *pakka* well costs Rs. 200. A larger number of *pakka* wells are being built by tenants since the new Rent Act and seven years' leases have become common, but wells are only built by tenants with the permission of the zamindar who helps them with wood and bricks. Permission is seldom refused for this purpose. At the last settlement I got a percentage reduction or some 3 or 5 per cent. on my improvements. I consider such allowance sufficient, and I was quite satisfied personally. I am in the habit of giving advances to my tenants for wells at an interest of 6 per cent. and have never required Government assistance. I am quite prepared to continue this in my own estate as the necessity arises.

WITNESS No. 21.—RAJA RAMPAL SINGH, Taluqdar, Kori Sadhauli, Rae Bareli.

Raja Rampal Singh.

28th Nov. 02.

Irrigation in Oudh.

The proposal for introducing canal irrigation in Oudh has long been under the consideration of the Government; but as the landlords did not receive it with favour, no steps were taken for carrying it out. We still hold that canal irrigation is not required in Oudh, as it is well protected by wells, *jhils*, and tanks. It is true that the tanks and *jhils* are of no service to us in years of drought, but on that account I do not put less importance to them. It is only in ten or fifteen years that Oudh is visited by famine, and even then we can pull on with the help of *pakka* and *kachcha* wells (the *kachcha* wells can be dug very cheaply and easily in most places of Oudh.) I do not think it advisable to carry out the costly proposal of introducing Sardah Canal in Oudh when it can be of real use to us only once, say, in ten or fifteen years. Besides that, canal water is not so much useful to the crop as is well water. It produces a kind of *reh* in the fields which diminishes the productiveness of the soil. They cause unhealthiness also in the villages situated close to them. If canals will be introduced in Oudh, the cultivators will have to pay a new tax on water which they at present get free of any duty. It is not a correct theory that the lifting of water in Oudh is very expensive. The cultivators practically expend very little in well irrigation. For the above reasons I do not advocate the introduction of canals in Oudh, and I see no reason why they should be forced on us. I quite agree with Mr. S. H. Butler in thinking that it would be ruinous to many districts of Oudh if canal irrigation will be introduced here.

There is still scope for the construction of tanks and *bandhs* and their extension should be encouraged by all means. If such works be taken in hand in famine years, they will serve double purpose—firstly, of providing local relief to the famine-stricken people; and, secondly, of improving the means of irrigation in normal years. In famine years relief is provided on unremunerative works such as the repairs of *kachcha* roads which get spoiled in three or four years, as they cannot be kept up in good repairs for want of funds. The landlords of Oudh in whose villages such works may be undertaken in famine years will, I think, agree to pay by instalments the ordinary costs of them, provided that they may be undertaken under their supervision and direction and with their consent.

The number of wells has increased a great deal since the last 30 years, yet there is much scope and need for their extension in order to protect Oudh against famine. In my own estate there is now one well of one *pur* to every 30 *bighas* of cultivated land. I do not perceive any marked indifference on the part of the people in extending the means of irrigation, as I see every year some more improvements are being made, though not so rapidly as ought to be the case. The following are the causes which are responsible for this slowness:—

(1) Want of capital.

(2) The rules of revenue assessment followed at the time of periodical settlements.

(3) The holdings of cultivators are not compact, *i.e.*, the fields of a *Kashtkar* are generally situated at a distance from one another.

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The indebtedness of cultivators is an admitted fact. They cannot afford to sink wells from their own savings. If they borrow from mahajans for this purpose, they have to pay exorbitant rates of interest which they find difficult to clear off even in their life-time. The *takavi* advances of the Government are not at all popular. A cultivator would prefer paying Rs. 24 per cent. per annum as interest to a mahajan to the taking of the Government *takavi*. The chief cause of the unpopularity of *takavi* advances is the rigidity with which they are recovered. The Tahsildars, in order to show their good work, recover the advances at the appointed time without paying any regard to the ability of the borrower to pay it. The profit of investment in land improvement is slow, but no consideration is given to this fact in making instalments for the recovery of *takavi*. Besides that, the cultivators are put to lots of trouble and expenses also in obtaining Government advances. The remedy which I propose for the evils which at present exist in the system and which are a hindrance in the way of cultivators, is that they should be given to Taluqdars on an interest of Rs. 4 per cent. and the Taluqdars may be allowed to lend them on an interest of Rs. 12 per cent. to their cultivators. They should be recovered by easy instalments, and a supervision should be kept that they are applied in land improvements and that the Taluqdars do not abuse the system. I think this suggestion, if adopted, will work much better than the existing one. The Taluqdars who are well off do give *takavi* advances to their Kashtkars, but I am sorry the number of such well-to-do Taluqdars is very small. The present system may be kept as it is and a trial may be given to the one I suggest. The high rates of interest which I propose for the Taluqdars to charge on their Kashtkars is simply to cover the bad debts and the expenses which they would have to bear in recovering from them.

The rules of the settlement provide that any increase in the rent rolls on account of the improvements made by the landlords should not be taken into consideration at the time of assessment, but the landlords generally remain in the dark whether the rule is observed in practice or not. At the time of settlement we are never informed what deduction the Settlement Officer gives for the improvements made by us, what are the rates by which he makes calculation, and in short how he arrives at the *jama* which he proposes to assess on us. In proof of my statement I quote the assessment remarks made by the Settlement Officer of Rae Bareli on Datauli, a village of mine—

"Belongs to the Karri Sadauli estate. The old zamindars are Kathbais resident who now hold under proprietary rights. There are five *abadis* with population below average. Tenants 61, Chhatriya 10, Ahir 23, Pasi 6, Kachhi 3, Chamars 6, Lodh 3. The northern part of the village reaching away from the main *abadi* is fairly good average *dofasli* soil, southwards it grows poorer and to the north of the jungle *usar* tract there is a good deal, *i.e.*, either *ek-fasli* or grows only linseed after rice. In the jungle tract there is scattered *ek-fasli* rice and some polo *rabi*. In a *tal* on the Pamde Pur border *ek-fasli* rice in very hard soil. Irrigation is fairly full. All the *dofasli* soil can be irrigated when it is necessary. Nineteen wells with 45 *purs*, 7 *tals*. The attested state is a moderate one. The estate being under the Court of Wards and now belongs to lenient landlord. Quoted rates are Rs. 5-4, Rs. 3-12, Rs. 1-8. Sair has been fully attested. The jungle wood was sold in the year of attestation for the first time for seven years. In 1287 it sold for Rs. 186; 1292, Rs. 300; 1299, Rs 1,150. Rs. 50 a year will be enough. The grazing income is from the scattered waste. It is sold by auction and the amount realized greatly varies: Rs. 30 may be added. Mahua 156, owner 129, tenants 40, mango baghs sold Rs 18-13-6, Rs. 18, other items are petty Rs. 138. Raja Rampal Singh has been more honest in regard to Sair throughout his estate than most landlords.

Improvements—Nil.

Actual under-proprietors' rents are accepted. Mafi and unrented lands are put at high cost rates, assets Rs. 1,869. The rise is small and the rental and estimate of Sair moderate. Extension of cultivation is probably possible, *jama* Rs. 930."

(Sd.) D. C. BAILLIE,
Settlement Officer.

My aim in quoting the above remarks at full length is simply to show that I was quite unaware of them and even of the rules. There were six wells besides two *bandhs* for which I ought to have got some allowance in revenue assessment; but owing to some mistake the Settlement Officer assessed the village as if there were no improvements (see the italicized remarks), and I not knowing the real state of things did neither ask for the correction to be made nor claimed any deductions for those improvements. Then, again, the rule provides that any increase in the rent roll owing to improvements made by landlords should not be taken into consideration. Suppose a landlord owing to some special causes does not enhance the rent of his tenants, then he cannot derive any benefit from the rule, and the land benefited by the improvement will be assessed as an irrigated land. Sometimes we enhance the rent of our tenants even after sinking a well or constructing a *bandh*. When we see that the tenants are not in good condition and that any rise in rent will make them worse we abstain from making enhancement. It can be very justly imagined that except on good and reasonable grounds one cannot fail to profit by the investment in land improvement. In support of my assertion I wish to quote the remarks of the Settlement Officer of my district:—

Assessment remark on village Inchauli.

"This is a large village of Karri Sadauli estate. It lies not far from the Sai and there is a very large portion of poor and sandy land. Two well marked ridges on south-west and east are extremely sandy and grow nothing but rain crops. But besides these the main *har* has, in nearly all directions, light and thin soil. Wells are few numbering 16 only and even all these have not sufficient water to work *purs*. Towards the centre of the village are several large ponds which can be used for irrigation, but two or three lifts are required and in many cases the cultivators who here belong to the lazy classes do not think it worth while to raise the water. The *Goindh* of the main *abadi* is poor and in the village there is no land that can be called good. That which is best is on the north-east where the soil is considerably stiffer. Tenants resident 165, Thakur 43, Brahman 14, Ahir 47, Pasi 19, Chamar 10, Pahi Kasht 33, Brahman 11, arrears are *nil*. The Chauhans hold decrees for much of the best land in pay rates which are favourable enough as in *sabzi*. The decrees were originally for half produce and in one case the estate is refusing to take the cash rent and asking for half the produce—a very different matter—

	Rs.
Sawai Fish	4
Grazing	28

Mahua 500 of zamindars who pay, half sold for Rs. 70 in 1300 *fasli*. Rate quoted Rs. 4, Rs. 2-8, Rs. 1-8.

Circle rates for tenants' land Rs. 1,672. Actuals Rs. 4,873. This is an extremely difficult village to classify. Rents are certainly very low. The occupancy tenants' rents are accepted, being at Rs. 4-8 per *bigha* for this village. Under-proprietors pay Rs. 3. This may be safely raised to Rs. 3-8, as they hold much good land, though some is poor. Rs 2-8 is put on *mafi* on unrented, much of it poor *bhur*, adding Rs. 120 for Sair, half for Mahuas and half for the Dhank jungle which is sold every five years; assets are Rs. 6,168. *The village has improved much in the Court of Wards time by encouraging the tenants who built wells by gifts of groves, etc., but here is no rise of rent in consequence.*

Jama Rs. 3,050.

Jama raised to Rs. 3,075.

Vide G. O. No. $\frac{3781}{1\text{-}80}$ ''

(Sd.) S. H. FREMANTLE,
Settlement Officer.

Assessment remark on village Karri.

"This village of the Karri Sadauli estate lies on the bank of Sai.—*The Raja has himself built one well and the Court of Wards did much improve the village; but as there has been no enhancement whatever and the jama has to fall somewhat, I allow nothing.* Assets Rs. 4,473, *jama* Rs. 2,230. The reduction on the village is Rs. 87.

(Sd.) S. H. FREMANTLE,
Settlement Officer.

Jama raised to 2,255.

Vide G. O. No. $\frac{3781}{1\text{-}802\text{-a}}$ ''

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I have italicized the remarks which show that no allowance was given to me for improvements. There is one point more which I wish to urge in this connection. If a tenant makes an improvement, his fields, as well as those of other tenants which are benefited by it, are entered as irrigated in the papers and in the settlement are assessed as such. That is to say, that owing to improvements made by tenants the landlords are more heavily assessed than they would be if there were no improvements. If this is not the case, how is it that villages well protected by wells, etc., are more heavily assessed than those where the irrigation is scanty? It is difficult to prove this fact here on paper, but I can say without fear of contradiction that it is a fact. Mr. S. H. Butler, a Settlement Officer, supports me in this view. He stated before the Commission as follows: "No doubt we were now taking at each settlement a smaller percentage of the assets, but all Settlement Officers would agree that the great defect in the system was that the man who worked up his village was assessed more than the man who left it alone." I think it necessary to note that the landlord cannot enhance the rent of tenant on account of such improvement, but by this I am not to be understood that I advocate such enhancement. Though the landlords of Oudh have the above-mentioned grounds for standing to a certain extent in the way of improvements, yet they very seldom do this. There appears to be a belief in certain quarters that the landlords prevent cultivators from making improvements. I very strongly deny the charge that is put on the Taluqdars of Oudh, and even if it be admitted for a moment, what other motive can they have for putting obstacles in the way of such improvement except those which I have pointed out above. The Taluqdars themselves make improvement as far as possible, but a work, which costs a cultivator Rs. 100, costs a Taluqdar Rs. 150 or even Rs. 200. They generally encourage their tenants to undertake such works by giving them *takavi*, wood, and other help which they require. It would be ungrateful on my part to say that the rules of assessment are not liberal, but they ought to be more liberal, so that the Taluqdars may themselves very readily and rapidly undertake such improvements and encourage by all possible means their tenants to construct such works.

There is no remedy for the third cause in the hands of Government. It is the duty of the landlords to see that if a cultivator sinks a well he should derive some substantial advantage from it. A cultivator having one or two *bighas* of land at one place cannot be expected to sink a well for his fields until he is encouraged by the landlord by getting some more land near the well which he proposes to sink

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1. *Q.* (*The President.*)—Rae Bareli is your *zillah*?—Yes.

2. *Q.* Have you property in other villages too?—I have three villages in the Lucknow district.

3. *Q.* You have heard the evidence given by Raja Tassadduq Rasul Khan. Do you agree with his views?—Not in all his views. As far as canals are concerned, I quite agree with his views. I do not think canals will be of much benefit for Oudh. As far as my experience goes, I do not think we require canals in my district.

4. *Q.* You have a great many wells in your district?—Yes. It is well protected by wells, *jhils*, and tanks.

5. *Q.* What protection do you think the *jhils* give in a season of drought?—Of course in a season of drought they do not give much protection, but we can use wells and dig *kachcha* wells also in the district, and they are very useful for our purpose. In ordinary years *jhils* are quite sufficient for our use.

6. *Q.* Then you think no measures are necessary on the part of the Government for the protection of your district from famine? Only relief measures are desirable in famine years.

7. *Q.* But one wishes to save the country the expenditure of these relief measures?—Famine comes once in every 15 or 20 years, and I think it will be useless to expend so much for one year. Even in those years we can sow and reap good *rabi* crops.

8. *Q.* (*Mr. Roberts.*) — Was there famine in Rae Bareli?—Yes.

9. *Q.* Were there relief works in 1896-97?— Yes, there were; but those relief works were largely for the labouring classes.

10. *Q.* (*The President.*)—You have said just now that you do not agree with Raja Tassadduq Rasul Khan altogether. Tell us the points in which you do not agree with him. We shall be glad to have your opinion?—He said that people will be very glad to utilise Government *takavi*. People are very much afraid of taking Government *takavi*, because the rules for its recovery are very rigid and they are forced to pay on the punctual dates, and no consideration is shown whether they have the means to pay the *takavi* or not. This is the reason they do not avail themselves of Government *takavi*, although they can get it at cheap interest.

11. *Q.* Would it be better if the repayment was allowed to be made over a number of years? How many years is it now, five or six?—Yes.

12. *Q.* Suppose the period of repayment was made 20 years, would it make them take *takavi* more readily?—Yes. But besides this they have a great deal of trouble from the underlings.

13. *Q.* How do you think you could get rid of that?—I do not know whether the suggestion would be liked by other taluqdars or not; but if this *takavi* could be given through the taluqdars, I think people would be very glad to avail themselves of it.

14. *Q.* (*Mr. Roberts.*)—What taluqdars would take money from Government?—I do not mean to say that the taluqdars should borrow from Government; they should be made agents. The money should be sent to the taluqdars and they should distribute it to the tenants.

15. *Q.* (*The President.*)—Would you hold the taluqdars responsible for the repayment?—No. You are not going to take recommendations from the taluqdars; why should they be held responsible. When they will recommend of course they will become security for it.

16. *Q.* Would they do it on these terms?—I do not think they will do that. If you adopt a system like this, it might work. If a tenant makes an application for *takavi*, it might be sent to the Deputy Commissioner through the taluqdar, and after the Deputy Commissioner has made an enquiry, he might direct the taluqdar to pay the money. Would that not be injurious? Now when they get the *takavi*, they would have to pay a good deal to the underlings.

17. *Q.* (*Mr. Roberts.*)—A good many witnesses have said that when *takavi* is given the underlings take a lot of money. I would like to know something definite about that. Do you know any case in which *takavi* has been given to a tenant and any large portion of it has been taken by the underlings?—I can quote several cases. There is a village of my own where people borrowed *takavi* in the famine year. They had first to pay to the *patwari*.

18. *Q.* How much?—One rupee.

19. *Q.* How much did they borrow altogether?—Some borrowed Rs. 7, some Rs. 10, and some Rs. 20.

20. *Q.* Do you mean to say a man who borrowed Rs. 20 paid a rupee to the *patwari*?—Yes.

21. *Q.* Whom else did he pay to?—He had to pay something to the *arzinavis* for writing a petition.

22. *Q.* How much?—Sometimes eight annas; sometimes four annas.

23. *Q.* The *arzinavi* is not a Government official. What else had he to pay now?—He has to pay something also to the man who has stood surety for him.

24. *Q.* (*The President*).—How much? —That depends on the need of the borrower. Sometimes eight annas; sometimes a rupee.

25 *Q.* (*Mr. Roberts*).—In the famine year, of course, there was a great deal of disorganization and *patwaris* had greater opportunities of doing this. In the ordinary *takavi*, suppose a man comes up for Rs. 250 to build a *pakka* well, how much would he have to pay out of that to the different people? How much would the *patwari* take?—The *patwari* won't take more than Rs. 2.

26. *Q.* The *arzinavis* would only take four annas or eight annas. Who else would take any money?—Then in the tahsils the chaprasies would take something.

27. *Q.* What would they take?—Sometimes two annas; sometimes four annas; sometimes eight annas. And then again at the time of realization, when the chaprasie is sent to realise the money, he always takes something. This

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morning I was talking to a tenant who has come from Inchauli, and he told me that at the time of repayment, if they have no money, they pay something to the chaprasie. He told me he paid a rupee once.

28. *Q.* If he took Rs. 250 from a mahajan what interest would he have to pay the mahajan?—He would have to pay Rs. 18 or Rs. 24 per cent.

29. *Q.* On Rs. 250 he would have to pay Rs. 60?—Yes.

30. *Q.* Would the different items they have to pay as *dustoorie* amount to so much as Rs. 60?—Not so much.

31. *Q.* So there is an advantage?—There is one thing more. They have to pay Government *takavi* on the punctual date.

32. *Q.* That is what I am coming to. Is it the punctuality, or is it the various *dustoorie* they have to pay; what is the real hindrance?—It is more the punctuality than the *dustoorie.*

33. *Q.* (*The President.*)—If the payments were prolonged over 20 years, do you think it would be much easier for them?—Yes; it would be easier, no doubt. Then there is one thing more in which I do not agree with Raja Tassadduq Rasul Khan, namely, about the allowance given at settlements for improvements. The rule provides, as far as I know, that any increase in the rent roll on account of any improvement made by the landlord should not be taken into consideration at the time of the assessment. There are certain cases in which the taluqdar may not enhance the rent of his tenant, and then no consideration is shown to the improvements which he makes. Such a thing happened in my own estate. Certain improvements were made at the time the estate was under the Court of Wards and compensation was paid to the tenants, but no enhancements were made, and I did not get any allowance for the improvements.

34. *Q.* (*Mr. Roberts.*)—Why should you?—Because the improvements were made. We had to expend something for those improvements.

35. *Q.* Why was no enhancement made?—There were several reasons. The Court of Wards thought that the tenants were too poor. Sometimes on account of too much rain and on account of several other causes when the tenants are too poor we do not enhance our rents, and then there is another cause. Supposing there is a well and it falls through, we are bound to make another well if the tenants are not going to make one, and when we construct a new well we do not get any allowances, although the rents remain the same.

36. *Q.* You say the rent remains the same, but is not the punctual realisation secured? Take this Court of Wards estate, for instance, when you say the tenants were too poor. Their rental was entered at so much a year, but because they were too poor you could not collect it every year, and when the well was made you could collect it every year?—Yes.

37. *Q.* So in that case you secured a certain enhancement?—Yes.

38. *Q.* So if on an average the rent roll was Rs. 500, probably before the well was built, you might collect Rs. 300, and after the well was built, you might collect the whole Rs. 500?—Yes, that would be a benefit, but I get no allowance from the Government. I say I get nothing. I was told by the Settlement Officer he would not give me any allowance.

39. *Q.* Were you assessed at 50 per cent. or 45 per cent., or what?—I do not quite remember just now.

40. *Q.* (*Mr. Roberts*)—You may not have been fully assessed?—It may have been so.

41. *Q.* When did your estates come out of the Court of Wards?—Fourteen years ago.

42. *Q.* When was the settlement made?—About seven years ago. We always remain in the dark whether such allowances are made or not.

43. *Q.* Cannot you get the information?—How can we get the information? We have to file an application and get copies of those returns and all that takes time.

44. *Q.* Are not you called before the Settlement Officer and the thing explained? Does not the Deputy Collector always come round and see what the *jama* is and what the proposals of the Settlement Officer are?—It is only when he takes an agreement that we are informed that so much *jama* has been fixed in this way.

45. *Q.* (*Mr. Muir-Mackenzie*).—Are you informed when the *jama* is fixed that it is made up of so much *jama* on the full rental and that so much allowance is made for improvements?—No.

46. *Q.* Would you like to have that information?—Yes.

47. *Q.* (*Mr. Rajaratna Mudaliar.*)—Have you to pay for copies, if you want to take copies?—Yes, we have to pay.

48. *Q.* (*Mr. Muir-Mackenzie.*)—If zamindars understood that they would get an allowance for improvements, do you think they would make many more wells?—It would be an encouragement to a certain extent.

49. *Q.* Do you think it will double the number of wells?—Yes; I cannot say that wells will be dug by every landlord, but it will be some encouragement for them. There is another matter which I would like to say a few words about and that is this. If a cultivator builds a well, other Kashtkars who have got fields adjoining to that will irrigate them from that well and they are entered as irrigated in the papers of the *patwari* and are assessed as irrigated in the settlement also, and according to that assessment we have to pay revenue.

50. *Q.* (*The President.*)—There is nothing left over you mean?—Yes. That is to say, we are made to pay heavily on account of the improvements made by the tenants.

51. *Q.* Do not you raise the rental?—How can we? If a tenant builds a well, we do not enhance the rent; we cannot do so.

52. *Q.* (*Mr. Rajaratna Mudaliar.*)—The owner of the well probably gets some remuneration from the adjoining landholders?—No; he does not get any; that is not the custom of the country. All other Kashtkars have a right to irrigate their fields from that well.

53. *Q.* You do not get a wet rate from the other Kashtkars?—No; we cannot do that; it is against the law. We can only enhance the rent after seven years.

54. *Q.* You enhance the rent after seven years?—Yes.

55. *Q.* Do not you enhance the rent of the adjoining landholder?—No.

56. *Q.* Only the owner of the well?—We cannot enhance on any of them.

57. *Q.* At the end of seven years you say you enhance the rent on account of a well?—No, not on account of a well. We have a right to enhance the rent even if there be no well.

58. *Q.* (*The President.*)—Have you any other points you would wish to lay before us?—No.

59. *Q.* (*Mr. Muir-Mackenzie.*)—You said you do not want a canal in your district?—Yes.

60. *Q.* Amongst other reasons, because even if the *jhils* failed, you could dig *kachcha* wells?—Yes.

61. *Q.* Are not there many places where *kachcha* wells cannot be dug?—It is only in sandy land that a *kachcha* well cannot be dug.

62. *Q.* Have you got a large proportion of sandy land?—Yes, but that land does not require much water.

63. *Q.* Does it get a crop even in a bad year?—Yes.

64. *Q.* Did you get a crop in 1896-97?—Yes, we got some crops in irrigated land.

65. *Q.* The *bhur* lands you mean?—Yes. The cultivators of *bhur* land do not try to irrigate their land.

66. *Q.* It seems to have been found in all the United Provinces that wherever a canal has been introduced the people have taken the water from it and have abandoned their wells; nor has there been any suggestion that the canal water should be removed and that they should revert to their wells. The people, in fact, have begged that the canal water should not be taken away. Do you think your people, if a canal was taken into your part of the country, would regard things in a different light to the people in other districts?—Yes, because at present they do not have to pay any duty on water.

67. *Q.* But they have all the expense of raising water from the wells?—That is true, but when there are three or four men in a family they can do it by themselves.

68. *Q.* (*The President.*)—You will want more bullocks?—I do not believe there will be an extra number of bullocks required for this purpose. They generally have one or two pair of bullocks and they can do it very well with these.

WITNESS NO 22.—MR. AHMED HUSAIN, Well Supervisor, Department of Agriculture, Lucknow.

Mr. Ahmed Husain.

28th Nov. 02.

(*To the President.*)—I have been employed in the Department of Land Records and Agriculture to supervise the sinking of wells for 17 months. Before that I was an overseer in the Public Works Department, Railway Branch. I was first appointed in 1880. I have made 182 well borings in 11 months in 20 districts. Of the 182 borings, there were only 32 in the Court of Wards and Government Estates, 8 for the department and the rest were for zamindars. One boring takes three to five days in sandy soil; in hard soil it takes as many as 20 days. In the 182 borings 120 wells were successful and 62 were not. The applications for borings have ranged from 4 per mensem to 19 per mensem. The work can go on all the year round, but rain of course interrupts it. I am now training two men for this work. There are at present ten borers with ten sets of tools which cost Rs. 420 each. None of these borers will go through block *kunkur* or rocky soil, and we require a better tool for that. Our boring pipes are 2½ inches in diameter.

2. *Q.* How can you tell where to bore?—I judge this from soil conditions and from neighbouring wells. I also get consulted as to wells which are defective. I gave advice regarding 180 wells and have cured defects in cases in which my advice has been acted upon.

WITNESS NO. 23.—MR. F. CLAYTON, Executive Engineer, Kumaon Government Estates.

(*Replies to printed questions.*)

Mr. F. Clayton.

28th Nov. 02.

A.—General.

1. Naini Tal district, known as Tarai and Bhabar, the Bhabar being the dry tract between the hills and the springs, and the Tarai the tract situated just below the springs. Two years' continual touring during the months November to May and reports during other months.

2. The average rainfall in each month of the year in this district during the year ending 30th September 1900 and 1901 as per statement appended.

3. (1) No, except that there is difficulty in maintaining tenants in the Tarai owing to the unhealthy climate.

(5) Water is utilized to about its limits; any further extension (and that can be but small) depends on saving water.

(6) Lack of energy more than lack of capital.

(7) No.

4. No such works; all are done by Government.

5. There is nothing of the sort here; the whole system differs from other parts, inasmuch as Government is the immediate landlord.

6. Irrigation cannot be extended except to a very limited extent, but no such thing can happen, as practically no village is started without irrigation. In the Bhabar land will not yield without irrigation and in the Tarai tenants cannot be obtained without it. If there were water to spare the people would be glad to use it all, but whether the already very damp soil and climate of the Tarai would be improved is very doubtful. I should say that if we could induce the people to be careful of the water they have, drainage is more needed than extension of irrigation.

B.—Canals of Continuous Flow.

7. In the Bhabar irrigation is absolutely necessary to get crops.

In the Tarai tenants would not be attracted without the prospect of high profits from the rice crop. Usually there is no great demand for water during the *rabi* as crops will flourish without; if the winter rains fail or are badly distributed water becomes necessary. But the great crop of the year is rice for which they need all the water they can get, even in years of ample rainfall. Indirectly, therefore, irrigation is necessary to get crops at all.

8. The whole crop is due to irrigation, in the Bhabar absolutely, and in the Tarai because tenants would not be found if there were no rice crop.

9. (1) In Kashipur pargana about Re. 1 on area actually irrigated occupier's rate. In all other parganas water revenue is part of the land revenue.

10. Government, the landlord, pays for all new *guls*.

11. The Tarai is peculiar in its climate and conditions. The spring level is high and must always necessarily remain high owing to the nature of the country. The springs from the hill drainage rise at the end of the gravelly soil of the Bhabar, and throughout the Tarai there is at a short distance below the surface a water-bearing stratum, in many places becoming actual quicksand. There used to be extensive swamps in a few places which were drained before the Mutiny by Captain Jones, and since then there are few swampy places that need be drained, any which exist are above the line of cultivation.

One great source of evil is that the system of irrigation has, as long as there has been cultivation, consisted of putting earthen dams in all the smaller rivers, which were consequently entirely turned on to the watersheds (where such exist in this complicated network of channels.) There were no masonry works, and no means of regulating the amount of water turned into these so-called canals, which were more properly misguided rivers. A big flood broke the earthen dam, but all smaller floods were turned into the "canals" in full volume. Gradually the old river channels got choked up from disuse, and then if a heavy flood came down the channel was no longer able to carry it, and as even the original river was only cut out of the level country, this meant much flooding of land.

The chief aim of myself and my two predecessors has been to re-open the old river channels, providing proper masonry regulators or falls at the heads of the canals, and giving masonry heads to them so that floods may pass down the rivers and only the quantity of water actually required be taken on to the watersheds; though even these it is difficult to work properly, as many of the heads are deep in tree or grass jungle, far from villages and men fear to live there.

I cannot say that this old system has actually caused any deterioration of the soil, though it is unlikely that it was improved, or that the ill-health of the people is due to this alone, though I have little doubt that the latter may be somewhat improved by improving the ancient and pernicious system of irrigation, by which no drainage line remained unchoked by bunds. The spring level is already high and must necessarily always be so; it is practically impossible to say how much we can reduce it by opening out the drainage lines, though the general state of the country must be thereby improved. Salt efflorescence is unknown.

C.—Canals of Intermittent Flow.

12. I have answered as if all canals were of permanent flow; practically they are so, as the bunds are in small rivers, and are made up again at once if they are breached.

There is only one which may be said to be of intermittent flow, *viz.*, the Kilaoli Canal taken out of the Dhela river. It is but a small *gui* really and is only used when the winter rains are short. Being a mere *gul*, the questions cannot well be answered.

As regards the manner in which the supply is maintained in my canals, I may briefly state that in the Bhabar small bunds are made with "putas," *i.e.*, three poles set like the angles of a pyramid. These are set up in a line and boulders placed round the legs, and the face is then filled up with brushwood till the necessary supply is obtained. Of course these get washed away in every flood of any size and are renewed as soon as the flood goes down. As the heads are placed in hill torrents, no more permanent method can well be used. For the Tarai I have already described the system.

14. (1) If the rains are late in coming the rice crop partly fails as it has to be sown late.

(2) If they cease early there is usually but slight loss. What affects the country more than direct rainfall is the relative discharges maintained by the hill streams and the Tarai springs. Rainfall may begin late or end early, but if sufficient to maintain the springs no great harm can be done.

15. No well irrigation.

20. Maintenance is all done by Government in the Tarai even to the clearances of the village *guls*. No legislation required. The approximate annual cost per acre irrigated in the Tarai and Bhabar Estates is Rs. 1-8-0 and Re. 1 respectively.

21. Many of the old Tarai canals were constructed by private persons, but there were so many disputes in connection with the matter that Government deputed Captain Jones to enquire into such cases and come to some arrangement with the zamindars. This was about 1848. Finally

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Government had to take over the canals, and owing to the failure of zamindars gradually to take over the land also and work it directly.

22. No.

D.—Tanks.

23. There are no tanks.

E.– Wells.

There are no irrigation wells except a few *kachcha* wells worked with *dhenkhes* by *kurmi* cultivators for small patches of garden, and these might be counted on the fingers.

In the west of the Kashipur pargana where there are no rivers from which irrigation can be effected (*N. B.*—This is not part of the Tarai proper,) well irrigation might be used if the cultivators can be got to adopt it.

Within a few miles of it, in the Moradabad district, *kachcha* wells are a good deal used.

In the Tarai proper well irrigation would be easy, but the cultivators are far too lazy (largely owing to ill-health) to use any but flow irrigation. In the Bhabar water is too far below the surface; the people depend on the canals even for their drinking water.

Statement showing average rainfall in each of the following parganas in the Naini Tal district during the years ending 30th September 1900-01.

Name of month.	Naini Tal.	Haldwani.	Ramnagur.	Kashipur.	Bazpur.	Godarpur.	Kechaha.	Kilpuri.	Khatima.
October .	1·0	...	...	...	...	...	...	...	...
November .	...	...	...	...	...	...	...	...	...
December .	3·29	1·47	2·84	·55	1·92	·84	2·22	·84	·58
January .	8·15	5·48	3·45	3·86	3·79	3·56	1·87	4·58	3·15
February .	2·82	1·58	2·72	1·90	1·65	1·37	·68	·67	·83
March . .	1·14	·85	1·0	·77	·40	·43	·55	·55	83
April . .	2·38	·68	1·0	·91	...	28	·38	·76	·27
May . .	2·10	1·76	·71	1·90	·41	1·33	1·0	2·0	1·39
June . .	6·54	3·28	2·54	1·28	1·22	·84	2·30	2·0	3·25
July . .	28·30	20·14	14·96	11·16	12·84	14·19	15·34	15·23	19·20
August .	34·74	23·74	23·65	18·10	17·0	11·63	17·43	17·87	22·87
September .	9·63	12·22	7·66	7·22	5·40	6·0	8·73	11·23	12·92

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1. *Q.* (*The President.*)—You are in the Naini Tal district?—Yes; I am north of Bareilly, Pilibhit, Rampur, and Moradabad.

2. *Q.* You do not go where the Sardah comes out?—Yes, from there to the end of the Naini Tal district.

3. *Q.* I see your rainfall report shows great variations?—Yes; it increases going eastwards.

4. *Q.* Do the people take water every year steadily whether there is heavy rainfall or not?—Yes; they do not take it quite so freely when there is heavy rain in the *terai*; in the Bhabar they always take it; they require it for growing any crop.

5. *Q.* That applies to *rabi* as well as *kharif*?—Yes; everything is irrigated.

6. *Q.* (*Mr. Roberts.*)—Bhabar soil is stony and water runs down in the form of a sieve?—Bhabar is dry country at foot of the hills where water all sinks down; there we tap the hill streams and bring them out in masonry channels; we tap small streams again for the Tarai. Bhabar has a very small depth of soil.

7. *Q.* (*The President.*)—Is extension of irrigation possible there?—We have reached our limits; we cannot do more except by saving water and the *pahari* cultivators will want teaching for a long course of years; all depends on them.

8. *Q.* Are there *pakka* water-courses?—Yes, in the Bhabar.

9. *Q* And of very high velocity?—Yes.

10. *Q.* You utilize pretty nearly all the water available?—Yes, in Naini Tal practically the whole of the water available is used.

11. *Q.* Do these canals pay themselves?—They pay very well, but they are not like ordinary Irrigation Department work; they come under the Revenue Department.

12. *Q.* (*Mr. Muir-Mackenzie.*)—What has been the expenditure on canals?—Half a lakh a year.

13. *Q.* How were they made?—Sir Henry Ramsay made these canals as he got extra revenue.

14. *Q.* There is no capital account?—No.

15. *Q.* (*Mr. Roberts.*)—There are no zamindari rights in the soil?—The present system is very well suited to the hill-man.

16. *Q* (*The President.*)—You say in your note: "If we could induce the people to be careful of the water they have, drainage is more needed than extension of irrigation"?—Yes; not drainge of *jhils* of which there used to be some very large ones. These were drained about the time of the Mutiny. Now, as irrigation has been carried on by damming the streams with earthen *bunds* and turning the whole of the stream on to the watershed, what is most wanted is to put in falls and regulators so as to turn flood water down the proper channel of the stream and only take into the canals what is really wanted for irrigation.

17. *Q* That means a great deal of clearance of these channels?—Many of them have become blocked; weirs have been put at the head of some canal.

18. *Q.* What is the discharge in the cold weather of the rivers you utilize?—In the Tarai the biggest one has a discharge of about 150 cusecs and drops to 60 or even less.

19. *Q.* That is subject to very heavy floods?—Yes.

20. *Q.* That would require a massive work?—We built one fairly big one; we have not so far taken up any of the big streams in the Tarai, because the work is too expensive.

21. *Q.* Have you *kachcha* bunds in the big streams?—No.

22. *Q.* Is there water going down?—Yes; it is used up lower down; in most of the big streams the water is so low down that we could not use it in the Tarai.

23. *Q.* What is the largest weir you have made in these streams? One hundred feet wide.

24. *Q.* Have these operations made a sensible difference in the sanitation of the Tarai?—It is difficult to say; there is a good deal of rice cultivation which must be pretty unhealthy.

25. *Q.* Is there much swamp left?—There is very little extensive swamp left; in rice cultivation it is practically all swamp in the rains.

26. *Q.* (*Mr. Roberts.*)—The proportion of cultivated area to the total area is small in the Tarai?—Yes, they won't break up land unless there is water and we cannot give them more water.

27. *Q.* (*The President.*)—You have not utilized the bigger streams?—No.

28. *Q.* Are there any deliberate operations for improving the health of the place?—The only way in which it is being done is by keeping on cultivation, and of course we give them drinking wells as far as possible.

29. *Q.* There are no extensive jungle tracts with swamp?—No.

30. *Q.* How is money obtained for these works?—It is a provincial fund.

31. *Q.* (*Mr. Muir-Mackenzie.*)—Have you as much money as you want?—Yes.

32. *Q.* (*Mr. Roberts.*)—Is it not a Tarai fund?—Yes, as opposed to Imperial it is Provincial; but it is not a Provincial Public Work.

33. *Q.* (*The President.*)—You know the place where the Sardah issues from the hills?—Yes.

34. *Q* You must know not only the Tarai and Bhabar, but the hill districts of Naini Tal?—I know a little about them.

35. *Q.* Have you ever heard of a valley where water could be profitably stocked for irrigation purposes in large quantities?—The outer hills are very rotten; you might manage it further in.

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36. *Q.* Are there such places?—Mr. Watts says there is a fine place on Alaknanda.

37. *Q.* Our impression was that there was no such place; the slopes were so very steep?—We use the Bhim Tal and Sath Tal a little, but they are small; for any others you would require a very high dam and the soil is very bad.

38. *Q.* (*Sir Thomas Higham.*)—I understand you are Superintendent of these canals?—These are Government estates; there is a special Superintendent in charge of them. I am lent to the Revenue Department to do the engineering part of his work.

39. *Q.* Is there a regular sum of money set aside for the expenditure on this work?—Yes.

40. *Q.* How much in the Terai and Bhabar?—About one lakh a year; that includes heavy repairs of the improvements that we are making. I have got roads and buildings too.

41. *Q.* That lakh does not include your pay on establishments?—No.

42. *Q.* What is the irrigated area?—About 50,000 to 60,000 acres in Bhabar, and in the Terai it is very much the same.

43. *Q.* Is irrigation increasing? You have been working for many years. How does it compare with what it was 20 years ago?—What we are doing is not so much increasing as securing what we have got.

44. *Q.* How does irrigation compare with what it was 20 years ago?—I have not got the figures.

45. *Q.* (*The President.*)—Have you been long there?—Three years.

46. *Q.* (*Sir Thomas Higham.*)—Has there been any increase?—In certain localities there has been; for instance, near Moradabad.

47. *Q.* It is not possible to increase further?—The only place where we have water is in the south-west.

48. *Q.* Is there any uncultivated land there?—No.

49. *Q.* I suppose you do not have to provide relief programmes; have you?—I have provided a small one.

50. *Q.* Have they ever had famine there?—No.

51. *Q.* (*Mr. Muir-Mackenzie.*)—For what proportion of the population?—On the revised census figures it amounts to 4·02; they are asking for more. The only place that has suffered is Jaspur in the west part of Kashipur.

52. *Q.* (*Sir Thomas Higham.*)—What are the works which you have proposed—canals or roads?—Canals are so small; I have put in roads.

53. *Q.* Is there anything in the shape of a tank for holding up water?—No, except in Kashipur Pergunnah, where there are some small ones, and these they fill from canals.

54. *Q.* Are they used for irrigation?—Not to any great extent, because they want water delivered in the *Terai* at a high level, so as to do flow irrigation; they will not lift.

55. *Q.* Are you making masonry heads in the *Terai*?—Yes.

56. *Q.* Do you put in a weir below it?—We generally put in a weir first.

57. *Q.* Masonry heads?—Yes, and later on put in the heads.

58. *Q.* Are they falling weirs and shutters?—I have some, but I am not very well satisfied with them. It is very difficult to get your *beldars* to work in the rains; many of the heads are buried in jungle and the men are afraid to stop there on account of wild beasts.

59. *Q.* I suppose you must have some establishments where you have a regulator?—Yes, but the difficulty is to keep them there.

60. *Q.* (*Mr. Muir-Mackenzie.*)—Has there been any objection raised to the extension of cultivation in the Terai?—No.

61. *Q.* Have you any difficulty in supervising these small operations extending over a large tract?—There is a great deal of difficulty.

62. *Q.* Does the efficiency of the system suffer on account of this difficulty?—It is very hard to make it more efficient till the climate grows better in the Terai.

63. *Q.* Is the expenditure considerable?—No; it is not high.

64. *Q.* Would it be safe to infer that the Irrigation Department could manage and supervise small works distributed over a large area without inordinate expense?—If you have them under control, it means a good deal of establishment. Our difficulty in the *Terai* is to keep our establishment on their work.

65. *Q.* In spite of these difficulties the system is fairly efficient?—It is only fairly efficient.

66. *Q.* It does a good deal more than pay its way?—Yes.

67. *Q.* (*Mr. Roberts.*)—There is a large revenue?—About 1 lakh is obtained from the *Terai* and 1½ from Bhabar; that is net, and includes land revenue as well as water revenue which is not separately assessed.

Witness No. 24.—Babu Sri Ram, Rai Bahadur, Assistant Engineer, Ganges Canal, Meerut.

(*Replies to printed questions.*)

Babu Sri Ram, Rai Bahadur.

28th Nov. 02.

A.—General.

1. Meerut and Muzaffarnagar districts. I held charge of a sub-division for the last 4½ years.

2. Meerut . }
Muzaffarnagar . } Separate list attached.

3. None whatever.

4. No such works constructed in these two districts to my knowledge.

5. * * * *
6. * * * *

B.—Canals of continuous flow.

7. As follows:—
(1) Double.
(2) 50 per cent.
(3) As follows:—
(*a*) No increase but decrease sometimes.
(*b*) 100 per cent.
(*c*) No crops without irrigation.

8. Yes, as under:—
(1) 25 per cent.
(2) No crops without irrigation.

9.
(1) * * * *
(2) * * * *
(3) * * * *

10. Very small, generally incurred by the cultivator. No security.

✓11. Yes:—

✓Bad health of population in wet seasons. Produce of land decreased by too profuse irrigation.

✓Remedy. Better system of drainage and frequent closures of Government channels.

✓Canal irrigation is practised in these two districts for the last fifty years and the evil is of the same standing. Drainage of the canal-irrigated land is as necessary as the irrigation itself, but it should not be overdone.

I have no experience of the irrigation classed under heads C and D.

E.—Wells.

34. For the whole area under reply.
(1) 15′ to 20′.
(2) From springs and percolation, both. (*a*) and (*b*) No saline, or liable to fail at any time.
(3) Rs. 200 for good *pakka* well.
(4) A well—constructed *pakka* well will stand for fifty years or more.
(5) *Choras* (leather bucket).
(6) 50 *kachcha bighas*=about 10 acres.
(7) 25 ditto =about 5 acres.

35. As under:—
(1) Double.
(2) 50 per cent.

Babu Sri Ram, Rai Bahadur.

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(3) As follows:—

(*a*) No increase, but decrease sometimes.

(*b*) 100 per cent.

(*c*) No crops without irrigation.

36. Yes, as under:—

(1) 25 per cent.

(2) No crops without irrigation.

37.

(1) * * * *

(2) * * * *

38. Whole paragraph. No.

39. * * * *

40. Very few. In the vicinity of canals no *kachcha* well will stand.

... ...

... ...

N. B.—The replies to paragraphs for which I can give no information have been left blank.

Rainfall of 1901.

Month.	Chitaura, Inspection House, Muzaffarnagar district.	Sardhana, Inspection House, Meerut district.	Remarks.
	Inches.	Inches.	
January 1901 .	2·3	2·1	I have no previous records with me. If average rainfalls of any number of years is required it may be prepared in Secretariat Office.
February „ .	0·3	0·3	
March „ .	1·6	1·3	
April „ .	0·0	0·0	
May „ .	0·0	0·0	
June „ .	0·5	0·4	
July „ .	8·0	8·8	
August „ .	11·7	13·4	
September „ .	2·3	0·3	
October „ .	0·4	0.0	
November „ .	0·0	0·0	
December „ .	0·2	0·5	
TOTAL .	27·3	27·1	

1. *Q.* (*The President.*)—You have been 32 years in the Irrigation Department.?—Yes; I have been on the Upper Ganges, Eastern Jumna and Agra canals.

2. *Q.* You are now in the Meerut Division?—Yes.

3. *Q.* What proportion of land is irrigated in your sub-division?—It varies from 20 to 100 per cent.

4. *Q.* Have you reduced much the size of the outlets?—Yes. Size has not been reduced so much as the number of outlets.

5. *Q.* And have you effected great economy of water?—I think so.

6. *Q.* What do you mean to do with the water?—We have done away with the *tatils* and we are going to improve the irrigation duties.

7. *Q.* Have you made any experiments as regards loss by percolation?—No, not personally.

8. *Q.* You say in answer to question No. 11—"Canal irrigation is practicable in these two districts." Where it is overdone why the percolation water is not used for irrigation?—In famine years the drainage gets dry and then the land is useless. You want water in these *jhils* for village purposes.

9. *Q.* Do you fill village tanks?—Yes.

10. *Q.* Do they get it free?—Yes.

11. *Q.* Have you ever had regulators put into drains?—At one or two places.

12. *Q.* Have you ever planted them with the object of irrigating from them?—We have nothing to do directly with that, but the cultivators do it and we have not forbidden it; in fact, we encourage it.

13. *Q.* The country you are in was largely irrigated by wells before a canal came in; is there any well irrigation there now?—Very little.

14. *Q.* Have you ever heard any complaints among the people that they would like a return to their wells?—No; they say the wells are spoilt; in some cases this is true; not in others.

15. *Q.* Do you think, where there are a great many wells if you close some of the *rajbahas*, that the people would complain very much?—Yes, they would; if you removed the outlets, they would hold off for some years.

✓16. *Q.* You have been on the Eastern Jumna Canal?—Yes, in Saharanpore. I have some experience of the evils of irrigation.

✓17. *Q.* Do you think it is over-irrigated in Saharanpore?—Yes.

✓18. *Q.* What part of Saharanpore?—Nánáuti. I have landed property there. The population is decreasing year after year.

✓19. *Q.* You must have seen a good deal of land that was covered by *reh*. Has any of it been improved by drainage and become fit for cultivation?—No, *reh* land never gets better, unless you put on manure or silt.

✓20. *Q.* (*Sir Thomas Higham.*)—Have you got any *reh* in your sub-division?—Very little.

✓21. *Q.* And in other sub-divisions?—In Etawah, Mainpur and Aligarh a third or a quarter of the whole area is covered with *reh*.

✓22. *Q.* Have you been making any drains?—One or two small ones; they are not wanted.

✓23. *Q.* You say in your note that you want a better system of drainage?—The outfall is limited.

✓24. *Q.* Is the country water-logged?—Meerut Division is very well drained; some drains require to be widened or deepened.

25. *Q.* How much do you irrigate there?—Our average is 50 to 60 per cent. of the culturable area; in some cases 80 to 100 is done; in some 10 to 20.

26. *Q.* I suppose in some cases they irrigate more than 100 per cent.?—No. There was a question raised yesterday about puddling, I should like to say that I have no faith in it. Various systems are employed; sometimes walls of puddle are built in the banks, and sometimes the perimeter is puddled. Former is the better system. There is great waste from the *gools*; sometimes amounting to 25 per cent.; the question is under consideration how to save the water wasted from the *gools*. We have no power to repair the *gools*; that is, we could repair them at Government expense, but could not recover the cost. That I think is worth consideration; power should be put into our hands and the establishment increased to look after and keep them in repairs.

27. *Q.* (*Mr. Rajaratna Mudaliar.*)—What is your total irrigated area?—Something over 2 lakhs of acres in the year in the whole division.

28. *Q.* What is your staff of patrols?—Sixty-two patrols, 13 amins and 2 zilladars.

29. *Q.* I suppose a considerable portion of your time is taken up in supervising the work of these people?—Yes, certainly, in checking measurements, etc.

30. *Q.* Would it not be an advantage if you were relieved of the work and if it was transferred to the Revenue Department?—We should lose interest in the work. This is a question that I think should be separately threshed out.

31. *Q.* Your staff could be transferred; could they not?—We would require persons to look after the channels; they are liable to breach; at the same time the measuring staff might go to the Revenue Department. A complaint has been made on one subject; it is said that if one field in a block is irrigated, the whole block is assessed.

Mr. F. E. Bull.

28th Nov. 02.

WITNESS No. 25.—MR. F. E. BULL, Executive Engineer, Rohilkhand Canals.

(Replies to printed questions.)

A.—General.

A.—1. Parts of the districts of Bareilly, Pilibhit, and Naini Tal (Terai).

Three months' experience in charge of the Division.

2. A three years' average gives monthly rainfall—

	Inches.
January	0·9
February	1·8
March	0·5
April	0·3
May	1·2
June	4·5
July	18·8
August	15·9
September	9·3
October	0·2
November	0·2
December	0·7

B. 9. (4) Figures taken from revenue reports show—

(1) Re. 0·97 by the cultivator to Government.

(3) Re. 0·10 by the owner to Government.

The rate being assessed on the area actually irrigated during the year.

C.—12 (1) In answering this question I am referring to the irrigation effected from temporary earthen bunds made up on the Baror, Dhora, Sankha, Deoraniau, and Kuli rivers in the Bareilly district.

The bunds are made up after the rains, *i.e.*, in November, and remain up for varying periods according as the first flood in the river is a high one or not.

(2) From channels constructed and maintained by the zamindars and cultivators, a large proportion of the irrigation being "lift."

(3) (*a*) In such years the bunds will often not be made at all, and if made, supply is maintained from December to June.

(*b*) All the year through the bund being made up several times during the rains to supply water for rice, the supply would be very precarious from March till the rains broke.

(*c*) Supply would be very precarious from October to March and non-existent after March until rain fell.

15—17. There are practically no wells in the area concerned.

(1) By the cultivator to Government, Re. 0·4.

The difference between this rate and the average rate on the continuous running canals is due to the fact that the larger proportion of the area irrigated is under *rabi* crops, the supply falling too soon for sugarcane, and the bund not usually standing long enough to give water for rice: and to the fact that the proportion of "lift" irrigation is large. The rate is assessed on the actual area irrigated during the year.

20. The construction of the bunds and their maintenance is paid for by Government: this includes their reconstruction if necessary owing to failure of the rains: the clearance and repairs of channels (with the exception of a short length of four miles maintained by Government) is paid for by the zamindars. The average annual cost to Government is Re. 0·1 per acre on an area of 17,300 acres. The system works fairly well; we have occasionally to enforce the provisions of the Canal Act with reference to the clearance of *guls*, but no further legislation is necessary.

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1. *Q.* (*The President.*)—How long have you been on the Rohilkhand Canals?—A year now.

2. *Q.* Where were you before?—I was on the Fatehpur Branch.

3. *Q.* In what districts are these Rohilkhand Canals?—In Naini Tal, Pilibhit, Bareilly, and a small one in Bijnor.

4. *Q.* How many sub-divisions have you?—Two and the Bijnor canals.

5. *Q.* Who are your Sub-divisional Officers?—One native temporary engineer, one native upper subordinate and also a native upper subordinate in Bijnor.

6. *Q.* You have no European assistant?—No.

7. *Q.* Is Bijnor separate from the rest of your division?—Yes, absolutely separate.

8. *Q.* Is there much extent of irrigation?—Very little; 25,000 acres in a good year.

9. *Q.* A gentleman in Allahabad spoke about the Kot Canal?—That is under the revenue authorities.

10. *Q.* What is the canal you have to do with?—The Nagina.

11. *Q.* The bulk of your irrigation is in Bareilly. How much is there?—128,000 in a good year.

12. *Q.* How much of that is *rabi*?—40,000 to 50,000.

13. *Q.* Do they take water steadily every year, dry and wet?—No; *rabi* varies a great deal; they are keen on water for sugar.

14. *Q.* Is that because your discharge varies largely?—No; there is a good deal of moisture in the soil.

15. *Q.* If you had more water, could you increase irrigation largely?—Yes.

16. *Q.* Have you got *tatils*?—You will never get rid of *tatils* in Rohilkhand.

17. *Q.* A large proportion of your irrigation is lift?—Yes, that is due to the irrigation direct from rivers in which lift irrigation is three times as much as flow.

18. *Q.* You say there never were wells in the country?—Yes, the soil is sandy and there is no *mota.*

19. *Q.* These canals are of old origin?—Yes, they were taken from old zamindari *gools;* the rivers have been bunded since the country was known.

20. *Q.* Is there any possibility of storing water in the Himalaya in the *Terai?*—I do not know of any place. I have not been up very far.

21. *Q.* Do you suppose that irrigation is less wanted in Moradabad than in Bareilly?—I do not know Moradabad at all.

22. *Q.* I suppose the Ramganga might be used in Moradabad?—It is a very unmanageable river lower down. I do not know about it up there.

23. *Q.* Can you say anything of irrigation in Bijnor?—The whole district was examined by Mr. Riddell.

24. *Q.* Has there been a recent enquiry?—Yes, the report went to Government in 1900 when I was at home.

25. *Q.* (*Sir Thomas Higham.*)—Does your division include the Rohilkhand Canal?—Yes, and the small canal for Bijnor—two small ones.

26. *Q.* What sort of canals are they?—Ordinary canals with permanent heads and weirs.

27. *Q.* Does your reply R to C 12 refer to the Bijnor Canal?—Rohilkhand only. One of the Bijnor canals has a permanent regulator; one has a temporary *bund,* which is to be replaced.

28. *Q.* You say in your reply to this question that the Rohilkhand canals are in fact all fed by temporary *bunds?*—Some of them; they are being replaced.

29. *Q.* Are they both on the same footing as regards assessment?—Exactly the same.

30. *Q.* The total area you irrigate is about 100,000 acres a year?—Yes.

31. *Q.* And it is on that you get this Rs. ·97 paid by the cultivators?—Yes.

32. *Q.* Have these water-rates been in force a long time, or have they been enhanced?—They were enhanced about six years ago.

33. *Q.* What is the ·10; that paid by the owners to the Government?—Yes, owner's rate. That is now abolished under the new settlement.

34. *Q.* In consequence of the land revenue having been enhanced?—Yes.

35. *Q.* Does the canal get any credit for the enhancement of land revenue?—I do not think so.

36. *Q.* What rate do they pay on the Bijnor Canal?—The rates are the same.

37. *Q.* One of our witnesses complained that on the Bijnor Canal rates were charged whether the water were used or not. Is that the case?—No.

38. *Q.* Is there much involuntary irrigation?—The only involuntary irrigation is a certain amount from *bunds* put up in the river. Some people want it and some do not.

39. *Q.* If they plough on it you assess them?—You have to.

40. *Q.* And if they do not plough?—No. I have had no complaints from the zamindar.

41. *Q.* We were told it was quite the system there?—The man who complained to you never sent me any written complaint. There are two distinct rates on the Bijnor Canal—one for Government canals and the other for irrigation from rivers where Government make up the *bunds* only as required.

NINETEENTH DAY.

Lucknow, 1st December 1902.

WITNESS NO. 26.—SHAIKH INAYAT ULLAH, Talukdar of Saidanpur, Bara Banki District.

Shaikh Inayat Ullah.

1st Dec. 02.

(*To the President.*)—I am also Manager for Raja Mahmudabad in Sitapur and Kheri. There was no distress in these districts in the famine years. Crops were irrigated from rivers in *kharif* and *kachcha* wells in *rabi*. *Kachcha* wells last from 1 to 7 years. Relief works were started for labouring, not for agricultural, classes. The zamindars and the cultivators do not approve of the proposed Sardah Canal; they dread the fees. Now they irrigate free of charge from *jhils*, tanks and rivers. They combine and help each other, so they incur very little actual expense in irrigating their fields. Even in dry years they find water close to the surface near *jhils*. In some places where the land lies water is found at a depth of 5 or 6 feet from the surfaces; in other places the depth from the surface is about 30 feet. I believe in well irrigation well water is best for irrigation of cane and opium.

(*To Mr. Muir-Mackenzie.*)—I always give leave to tenants to make wells; and they always ask for leave to do so. I never take *nazrana* from them; on the contrary, I give them help, wood, etc. If a well fails, I give them money to construct another and make no enhancement for ten years. At the end of ten years the legal enhancement is taken. I recover the money if a well is successful. I often do this. Wells often fail, when supervision is not good. We get experts from Shahjahanpur or Rampur and pay them twelve annas or a rupee a day. They do not make borings; they have their own methods. I intend to try the Cawnpore man.

WITNESS NO. 27.—CHAUDHRI NASRAT ALI, Khan Bahadur, Zamindar of Hardoi.

Chaudhri Nasrat Ali, Khan Bahadur.

1st Dec. 02.

(*To the President.*)—In the *kharif* season of 1897 there was great distress in my zamindari. The land is uneven *bhur* on one side, *usar* and *matyar* on the other. There is very little *dumat*. *Kharif* was very poor in 1897. We made many wells and tanks in the *rabi* which was therefore good. Results from tanks were not good. There has not been much increase in wells in Hardoi. It is difficult to sink wells in the *bhur* tract. The opinion of the Cawnpore expert was found very useful and led to success in sinking wells. We made six wells on his advice. The water surface falls greatly in the hot weather; 15 to 20 or 30 feet. A canal is not so good as wells for irrigation. A *kachcha* well which can be made for Rs. 3 or Rs. 4 lasts 2 or 3 years. A *pakka* well costs Rs. 350, or *kachcha-pakka*, above water surface, Rs. 200 or Rs. 250. A well waters about 15 acres in one season. One *pur* is worked by 8 men; men do more work than bullocks. If the period of payment is increased and rate of interest decreased, the cultivators would take *takavi*. I propose 4 per cent. interest. I never took *takavi* myself. I do not know how it takes to recover *takavi*. Twenty years would be too long. Apart from advancing of *takavi* he would like to have also assistance of experts in making borings and bricks. Some *pakka* wells last for hundreds of years. Cultivators with small remuneration help each other in working wells. Larger men use bullocks. There was excellent *rabi* in 1897, because help was given by Government and zamindars in making *kachcha* wells, etc. In 100 wells 60 were due to Government help. People depend for their own food on coarse millet owing to the scarcity of rain and means of irrigation. In one of my villages water is reached by 5 lifts (*nádhas*) from Gumti by means of *Beris*. Each *Beri* is worked by baskets. Each lift requires one *Beri*. Cultivators can give no security for *takavi*, and zamindars could not take the risk of standing security for cultivators. The tenants are in the hands of the *bania* who takes his share of the produce.

WITNESS NO. 28.—The Honourable BABU SRI RAM, Talukdar, Lucknow.

Babu Sri Ram.

1st Dec. 02.

✓1. *Q.* (*The President.*)—You own lands in Oudh?—I own lands in Lucknow, Fyzabad and Unao.

✓2. *Q.* What is your feeling about a canal being brought into these lands?—I think it is not necessary.

✓3. *Q.* Do you think it would do harm?—Probably in some places tracts of land would get water-logged.

4. *Q.* Are you familiar with the Doab on the other side of the Ganges?—No.

5. *Q.* Perhaps you are aware that there has been canal irrigation there for 50 years?—Yes, I know that.

6. *Q.* If you told the people there that they would have to go back to their wells, they would not like the idea?—No doubt; it is a question whether our resources are not sufficient.

7. *Q.* What do you think the poor people would say to it?—In one sense it would do harm to the labouring classes, because in the *rabi* season they are employed to water fields from wells and tanks, and if you run a canal through, they would lose their means of livelihood; from November on for a couple of months they get sometimes 2 annas a day in that way.

8. *Q.* Was distress very great in 1897 in Oudh?—Yes, in the western part, in Lucknow, Unao, Hardoi and Rai Bareli.

9. *Q.* In a year like that would the people like to have a canal?—Where advances were made people dug wells; in *matiar* land *kachcha* wells last; they do good service during the *rabi*, but during the *kharif* they are not much used.

10. *Q.* You must count on the *kharif* being lost?—Perhaps it would be in some places.

11. *Q.* There is not much rice?—In the eastern tracts there is.

12. *Q.* The food of the people is wheat and barley?—Only of the better classes; the poorer classes live on millets, *kodo* and a coarser kind of rice.

13. *Q.* With your great experience of this country, do you think sufficient provision would be made against famine if wells were extended and encouraged?—Yes.

14. *Q.* Because you could not count upon the *jhils*?—No; *jhils* are becoming shallower day by day owing to the soil getting into them. Steps should be taken either by Government or in co-operation with zamindars to deepen these natural reservoirs of water.

15. *Q.* It would be expensive?—No doubt, but in some places it would not be very expensive; something should be done in that way, otherwise in course of time a good many of the reservoirs will be lost; some were very deep, 25 to 30 years ago; now they only last for a single watering in the *rabi*; formerly they ran up to the end of the hot season.

16. *Q.* (*Sir Thomas Higham.*)—Do you mean *jhils* or tanks?—Both; by some process they are becoming shallower.

17. *Q.* (*The President.*)—A proposal has been made to dig a canal from the Sardah, merely to carry water during the months of September and October to fill these *jhils* and low lands, and they would then be closed; would that be a good thing?—It would have to be seen if it was worth while incurring the outlay.

18. *Q.* Assuming it would be, do you think it would be for the good of the country?—Not in these places.

19. *Q.* And as regards Hardoi?—Perhaps in some places.

20. *Q.* Do you think that the construction of *pakka* wells should be encouraged more than it is?—Yes.

21. *Q.* How would you set about that?—I think rules for advancing *takavi* should be made easier, and there should be some provision on behalf of Government to see that the money thus advanced was really spent on the object for which it was given.

22. *Q.* Is there any provision?—No; zamindars owning small lands take money, but do not spend the whole on the object for which they take loans.

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23. *Q.* In what way should it be made easier? Would you give a longer time for repayment, or what?—The rate of interest should be lowered; now money can be got from mahajans at 9 per cent. and the period of repayment should be extended.

24. *Q.* Up to what time?—No hard-and-fast rule should be made; it should depend on the man's income and he should get increased facilities.

25. *Q.* Would you go up to 20 years?—I think that is too long; 15 would be enough.

26. *Q.* (*Mr. Muir-Mackenzie.*)—Why is 20 years too long?—15 is half the term of the settlement, though there is no particular reason why it should not be 20.

27. *Q.* (*The President.*)—Is it looked upon as a hardship that the dry land is assessed as wet after a certain time?—Yes, it is; at the last settlement there were complaints on the subject; there have been cases in which allowances for making improvements were not properly granted.

28. *Q.* (*Mr. Roberts.*)—The rules themselves are not to blame; are they?—No.

29. *Q.* During the currency of the settlement?—No.

30. *Q.* Then the whole benefit of the improvements in so far as it is assessed by increased assets is allowed for?—Yes.

31. *Q.* That is fair enough?—Yes; it is the application of the rule that I have to find fault with.

32. *Q.* You can go from the Settlement Officer to the Commissioner. Are you not aware that in some cases an additional allowance has been made on appeal?—Yes.

33. *Q.* (*The President.*)—Have you any experience of the employment of the well borer from Cawnpore?—No.

34. *Q.* Have you heard about him?—Yes.

35. *Q.* It has been proposed to us in some places that in each zillah there should be boring tools to help the people as regards sites for wells; do you think that would be of use to them?—I think the experience of the villagers on the point is sufficient.

36. *Q.* They do not often make mistakes?—No; the notion prevalent among them is that, if they place earthen pots full of water on the ground on the night of the *Dewali* and these are not dry in the morning, there is water in that spot.

37. *Q.* (*Sir Thomas Higham.*)—Have you any tanks on your own estate?—Yes.

38. *Q.* Have you spent any money in deepening them?—In some cases where I found there was not sufficient water for cattle.

39. *Q.* Not for purposes of irrigation?—No; the outlay would have been too great. During the famine of 1896-97 I had two tanks deepened and one before that.

40. *Q.* Was that done by famine labour?—No, by my own tenants.

41. *Q.* You say the outlay would be too great?—Yes, and then again there are *jhils* owned by different villages, and it is difficult to get the owners to co-operate. There are rules laid down in the village administration papers as to the circumstances under which the people of a village are to have water. It is very difficult to settle the rights of the different parties in the case of *jhils* which are on the boundaries of several villages.

42. *Q.* In the case of your own villages there would not be that difficulty?—There are villages in which I own only a portion of a tank.

43. *Q.* In the case where you own the whole would you be prepared to spend money in clearing it if you got assistance from Government?—Yes.

44. *Q.* Would it pay you?—Yes, in the long run it would.

45. *Q.* They deepened a lot of these during the famine?—Yes, but it often happened that the tanks would not hold water afterwards.

46. *Q.* Is silt ever applied to fields as manure?—No; they do not often employ it in that way, but it is used for garden purposes and for mangoes, etc.

47. *Q.* Do they carry it far?—Yes.

48. *Q.* (*Mr. Muir-Mackenzie.*)—In spite of a good *rabi* you had scarcity in your district in 1896-97?—Yes.

49. *Q.* Your wells only succeeded in saving the *rabi*?—Yes.

50. *Q.* If a canal was brought, would it not be of use in saving the *kharif*?—I think the proportion of crop that would be saved would not be equivalent to the expense of bringing it.

51. *Q.* The expense part of it is the business of Government; leaving that out of the question, the good *rabi* you had did not suffice to prevent the scarcity; did it?—The *rabi* crops were not cut till March and the scarcity lasted till then

52. *Q.* Would not the canal have saved the *kharif* is what I want to know?—It would in some places

53. *Q.* Why? Could not the lands be reached?—Yes, we have to place the disadvantages against the advantages.

54. *Q.* I leave aside the disadvantages for the present. I wish to know if you had a canal whether the *kharif* would have been saved?—In the abstract, yes, it would have been saved.

55. *Q.* Looking at the question practically, would you not have got water on the fields to save it?—Yes.

56. *Q.* And would that not have stopped the famine?—This happens at long intervals; we have to see, looking at the intervening years, whether it is worth while spending so much money.

57. *Q.* (*Mr. Roberts.*)—Was the scarcity due entirely to the failure of one *kharif*?—There were two things; we had in the preceding *rabi* too much rain, and then there was a total stoppage of rains in the *kharif*.

58. *Q.* There was a partial failure of *rabi* and a total failure of *kharif*?—Yes.

59. *Q.* (*The President.*)—You said wells were not used; do tenants not water *jowar* and *bajra* from wells?—They generally grow *kharif* crops where they think wells cannot reach; they select the most useful places.

60. *Q.* Do not they make *kachcha* wells to save this crop?—Yes, sometimes they do, but you cannot have them everywhere.

61. *Q.* Where there is a well they would irrigate?—Yes,

62. *Q.* Then there is no prejudice about wells?—No: none whatever.

63. *Q.* (*Mr. Muir-Mackenzie.*)—How soon was it known that the *kharif* was going to fail?—By the middle of August.

64. *Q.* If by the middle of August a large amount of *takavi* had been given, would the people have made *kachcha* wells to save their *kharif*?—I think they would; the making of these wells takes from ten to twelve days.

65. *Q.* When did they get *takavi*?—In that year *takavi* was advanced long afterwards.

66. *Q.* If they had received advances in August, would they have saved the *kharif* by digging wells?—Yes. In October it was officially acknowledged that there was a famine.

67. *Q.* (*Mr. Roberts.*)—Would not zamindars know better than Government what the prospects of the crop were?—Yes.

68. *Q.* It is only from information supplied by them through the District Officers that the Government would know there was going to be a failure?—Yes.

69. *Q.* During the famine zamindars themselves made many *kachcha* wells at their own expense?—Yes.

70. *Q.* In some places quite as many as Government?—Yes, perhaps.

71. *Q.* At all events they made a large proportion; you say, if Government had advanced *takavi* in August, it would have saved the *kharif*; why did not the zamindars did *kachcha* wells themselves?—Those who could afford it did.

72. *Q.* And did they water the *kharif*?—Yes.

73. *Q.* Was any portion of the *kharif* saved?—Very little.

74. *Q.* As a rule, the zamindars did not exercise that amount of forethought that would have led them to build wells to save the *kharif*?—Yes, in many cases they did not.

75. *Q.* (*Mr. Muir-Mackenzie.*)—Was the reason that they thought the wells they had would be enough for the purpose?—No; they expected rain daily.

76. *Q.* (*Mr. Rajaratna-Mudaliar.*)—You said that in practice the concessions allowed by Settlement Officers are not as liberal as the rules permit; what means have you of knowing what concessions they allow?—They take the outlay and then take into consideration the area that is benefited by the outlay and make a calculation accordingly.

77. *Q.* In your case did you know the calculation?—In my case they did not allow anything.

78. *Q.* Did not you appeal?—No; I did not think it worth while. We know the result of the calculation, but not the process.

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79. *Q.* (*Mr. Roberts.*)—You have any opportunity of bringing before the Settlement Officer any improvements you have made?—Yes.

80. *Q.* (*Mr. Rajaratna Mudaliar.*)—If mistakes are brought to his notice, does not the Settlement Officer rectify them?—Yes.

81. *Q.* (*Mr. Roberts.*)—You are not very heavily assessed; are you?—No.

82. *Q.* (*Mr. Rajaratna Mudaliar.*)—In the settlement are lands irrigated by wells assessed at wet rates?—Yes.

83. *Q.* Is your revenue assessed on wet rates or on dry rates?—It is assessed on the result arrived at by taking both rates into account; the revenue is assessed on the actual rent roll.

84. *Q.* (*Mr. Roberts.*)—The difficulty in giving *takavi* is to give to cultivators who can give no security?—I do not think it is advisable to advance them any money unless they can give good security.

85. *Q.* You would not care to give security for them as zamindars?—There are some for whom I would. I know who are the good *Kashtkars* who would pay.

86. *Q.* Those are the men who have least need of *takavi.* Those who would be most likely to take *takavi* for wells are those who could not give security for the advance?—Yes.

87. *Q.* Do you see any way out of the difficulty?—(No answer).

88. *Q.* What kind of security do they give?—From other tenants—personal security.

89. *Q.* If they have groves, they are entitled to the wood of them?—Yes, they can give the groves as security.

Witness No. 29.—Mr. W. C. Peppé, part owner of estates in Gorakhpur.

Note on the Irrigation System in the Birdpore Estate, District Basti.

Mr. W. C. Peppé.

1st Dec. 02.

The Birdpore and Alidapore Estates belonging to Messrs. Gibbon, Peppé & Co., and the Newra Estate belonging to Mr. Bridgman are in a ring fence adjoining one another, and situated in the extreme north-east corner of the Basti district on the Nepal Frontier.

The area of Birdpore by the last settlement is 29,374 acres, of Alidapore 9,891 acres, of Newra 10,195 acres. These Estates were given out as jungle grants about the years 1835-40.

Many schemes were tried to bring this land into cultivation, but with little or no success. For many years indigo was persevered in at great expense and five factories were built, but it was found the land was unsuited for indigo cultivation and it was eventually abandoned.

Mr. Bridgman and Mr. Peppé now set their minds to settle tenants on these lands, and give them a free hand to bring the lands under cultivation as best they could, they only helping them with finances, seed, etc. Their efforts were crowned with the greatest success, tenants crowded in and in a few years the jungle and grass lands gave way to flourishing rice fields. The rapidly increasing rice cultivation, which seemed the only cultivation suited to the land, made it apparent that, unless it was protected by some means of irrigation, the tenants would be subject to great loss whenever there was a drought or were a prolonged cessation of the rains. Mr. Peppé recognising this resolved on providing irrigation, but for some years many incidents prevented him from carrying out his scheme; among others the mutiny; but in August 1864, owing to the failure of the rains, Mr. Peppé attacked the problem in earnest and commenced work by damming up the Siswa river temporarily, and utilising the water by running it down the Mekra nullah or 'soi' (depression) which then contained the chief rice lands on the estate, and which extends from the north of the estate to some nine miles south; in this way he managed to save the bulk of the crop, and what was still more important, it proved to him and to the tenants the feasibility and necessity of making permanent irrigation works without further delay.

From 1864 for years Mr. Peppé devoted his whole attention to planning and constructing an irrigation scheme for the whole estate, and by the year 1875, he had, in conjuncton with the late Mr. Bridgman, completed a system by which the whole area of the three Estates of Birdpore, Newra and Alidapore, consisting of 50,000 acres, could be irrigated and were thus made more or less independent of the rainfall. I may add their labours were most loyally backed up by that of their tenants, without whose aid such works could not have been undertaken and completed.

The general idea of the scheme may be stated in a few words. There are four rivers running through the Estate from north to south, and the general fall of the ground is about one foot per mile from north to south. Taking advantage of this these streams were dammed up as far north as possible, the water-level was thereby raised and storage reservoirs were formed, and the water which formerly flowed down the river was now led by a thoroughly scientific system of canals throughout the whole of the estates.

It was a simple matter to dam up the rivers with an earthen embankment, but the difficulty arose, how was the surplus water or floods to be allowed to flow off. There were many examples of such works in India where the water of huge rivers, such as the Ganges and Jumna, were regulated and kept under perfect control, but such works had been built on such a gigantic scale and at such enormous expense, they gave little or no information or encouragement for works that had to be carried out by private individuals at their own expense. Yet the problem to be solved was the same, to store up water and to make provision for enormous volumes of water to pass down the river in times of flood, without injury to the sluices and embankments. To give an idea of what floods would have to be provided for, I may state that the average rainfall here for the last twenty-four years is 63·60 inches, and it is not uncommon to have a fall of eight or nine inches or more in the twelve hours; on the 9th September 1888 I myself measured 22 inches in the twenty-four hours, where we experienced the highest flood on record, and yet this flood was passed through the masonry weirs on the several reservoirs without doing any damage whatsoever.

The rainfall varies from under 40 inches in some years to over 80 inches in others.

Mr. Peppé showed the greatest ingenuity in solving this question of the weirs and his masonry weirs and gates have proved most successful; the heaviest floods are met and passed through without any difficulty and they are worked with the minimum of cooly labour.

The rivers Junwar, Siswa and Merthi have been dammed up and are provided with masonry weirs and escape gates; the Tillar river to the extreme east of the Birdpore Estate was also dammed up, but the weir was carried away in a flood before being completed and it has not since been rebuilt.

The Junwar and Siswa rivers are merely fed by surface drainage and take their rise in small *jhils* a few miles inside Nepalese Territory; the Merthi is a much more pretentious stream and is fed by a spill from the Bangunga river which rises in the hills inside Nepal.

An enormous volume of water flows down the Merthi river; whenever there is a heavy fall of rain a freshet comes down. For years the greater portion of this water could not be stored or utilised, but some years ago a canal 12 feet at bottom was dug from the Merthi reservoir into the Siswa reservoir and the surplus water now flows into the Siswa reservoir.

Still later a new reservoir called the Majowlie was constructed behind the Siswa reservoir, but at a lower level, into which the surplus water of the Merthi is allowed to flow through a canal 12 ft. at bottom.

This reservoir when full covers an area of 250 acres and has an average depth of 5 ft. of water. This year in July 15·16 inches of rain fell and yet not a drop of water was allowed to flow down the Merthi, but all of it was run down into the Majowlie reservoir, and the Merthi reservoir escape gates were not opened till the 4th August; from this one can judge of the enormous storage capacity of the Majowlie reservoir.

The end of July was a most critical time, and the chances were that the rice crop would entirely fail if rain did not fall; rain did fall, but even if it had not fallen the crops on these estates would have been carried on for another month by water from the reservoirs, and would not have suffered any damage.

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The Merthi reservoir is provided with three weirs, one with seven gates 5′ 6″ × 5′, one of five gates 5′ 6″ × 4′, and one of six gates 5′ × 2′ 6″.

Total waterway about 400 sq. ft. All the weirs are built of brick and mortar and are of the 'ogie' form. The side and front walls are built on wells 10′ × 6′, sunk to an average depth of 10 ft. below the bed of the river. In all 39 wells were sunk. The level of the water has been raised 16 ft. above the bed of the river. With all the gates open in the first two weirs and leaving any initial velocity out of the question, the discharge is 589,874 gallons per minute.

There are two canals of 12 ft. at bottom and one of 8 ft. flowing out of it.

The Siswa reservoir was constructed by throwing an embankment about one mile long and 8 ft. deep across the valley of the Siswa river and placing in it two masonry weirs, one of 7 gates 6′ × 5′ and one of 5 gates of 6′ × 4′. The water has been raised 12 ft. above the bed of the river. There are three canals of 8 ft. each flowing out of it.

The Majowlie reservoir, as already stated, is situated immediately behind the Siswa reservoir; in fact there is only the embankment separating them. The difference of level of the two reservoirs when full is only 18 inches. The reservoir has been formed by throwing a long earthen embankment across the valley of the Siswa river. It is provided with one weir of ten gates of 5′ 6″ × 5′ 6″ and two surface escapes which come into action as soon as the reservoir is full; and in time of floods as soon as the water reaches 5′ 6″, that is, when it comes level with the top of the gates these overflows pass off all the surplus water.

The water-level has been raised twenty feet above the bed of the river. When all the gates of the main weir are open the discharge is 661,580 gallons per minute.

The walls are built on 26 wells sunk to an average depth of 10 ft. There are three canals flowing from it, one of 8 ft. and two of 4 ft. broad each. This reservoir is chiefly used to supply the lower lands with water.

The Junwar reservoir is situated in the Alidapur Estate and was built by the late Mr. Bridgman. It is provided with one weir of twenty gates of 5′ × 3′ 6″ and has three canals of 8 ft. each flowing out of it.

From these reservoirs main canals are run along the high lands to the extreme south of the estates, and from these again distributaries are run off in all directions, so that practically every field is put into direct communication with the canal. With the exception of a few villages in the immediate neighbourhood of the reservoirs, the whole of the land in these estates is under flush irrigation.

The longest main canal in Birdpore is about seventeen miles long, and the total length of main canals and distributaries in 1889 was one hundred and ten miles, and many canals have been added since; I cannot give the exact figures for Newra and Alidapore but as both estates are as fully provided with canals as Birdpore, I calculate there are in Newra 40 miles of canals, and in Alidapore 25 miles.

The total area of land taken up with reservoirs and canals in Birdpore is 826 acres.

Out of a total cultivated area of 22,330 acres in Birdpore 20,766 acres are protected by flush irrigation and 1,566 are only partially so, by lift irrigation; the irrigated lands in Newra and Alidapore are proportionally greater as they are both further from the reservoir.

'Jarhan' or transplanted rice cannot have too much water once it is planted out. A watering, or even covering of the fields with 3 or 4 inches of water, is of no use; nothing under nine inches or a foot will do any good. From this it will be understood the amount of water that is required to protect rice cultivation; and to make matters worse, one and all want the water at the same time, the moment there is any prolonged break in the rains.

The construction of these irrigation works have cost a vast amount of labour, material and money. The masonry works amount to 220,254 c.ft. of brick work; the embankments to 1,731,584 c. ft. earthwork and the canal excavations to 13,283,066 c. ft. of earthwork.

There is no direct charge made to the tenants for water, but it is amalgamated in one lump sum along with the rent. The rent of land varies very considerably according to the facility with which it can be irrigated. Nowhere does this extra charge for water even approximately approach the water tax imposed by Government throughout these provinces and in Bengal on water supplied from Government canals.

The rent in Birdpore, including the extra charge for water, does not exceed the rental of similar lands in the neighbourhood but outside the estate, which are wholly unirrigated by artificial irrigation.

The tenants quite realize the benefits they derive from irrigation and they are always ready at a moment's notice to go eight or twelve miles to repair any breach that may have been caused to any of the embankments by a flood.

The successful working of these irrigaton works is chiefly due to the good feeling existing among the tenants, their willingness to work and help for the common weal regardless of any individual benefits to be derived thereby. Of course, as the reservoirs are dependent for their supply on the rainfall if there is a complete failure of the rains they run dry, but during the last 35 years, with the exception of 1873-74, though we have passed through some great droughts and have in some years had short crops, yet on the whole we have managed each year to completely save the crop.

This year for instance, though the rainfall has been most erratic and the rice crop was on the verge of being ruined more than once, with the help of the canals we have a magnificent rice crop in all three estates, notwithstanding that the rainfall is 49·47 inches against an average of 63·60 inches.

I have not seen such a crop during my residence here for the last 28 years.

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1. Q. (*The President.*)— We have heard a great deal about your irrigation works. Perhaps you will kindly tell us about them. Where do you get your water from?—There are three streams which come from Nepal, and these are bunded on the Nepal frontier a little inside the estate. We have constructed earthen embankments across the river valley with masonry weirs to let off all surplus water.

2. Q. Is that embankment repeated every year?—It is permanent; the first embankment was commenced in 1864 and the last reservoir and embankment was completed in 1878.

3. Q. It stands right through the floods?—Yes. The Alidapur Estate formerly belonged to Mr. Bridgman, and one embankment built by Mr. Holdsworth is probably 2 miles long; an earthen embankment.

4. Q. (*Sir Thomas Higham.*)—What height?—This one varies from 4 to 5 feet and in the bed of the river it is probably 20 feet, called Jaunwar reservoir and embankment.

5. Q. (*The President.*)—That is a big work?—There are other two embankments, very heavy ones (shown on map). The Siswa and Merthi embankments.

6. Q. (*Sir Thomas Higham.*)—You have masonry weirs?—Yes. We have 40,000 acres, almost entirely rice, irrigated out of 42,000 on the three estates,—Alidapur, Birdpur and Newra.

7. Q. (*The President.*)—You have difficulties in dry seasons with respect to Nepal?—They shut off our water of course: they have only to throw a small embankment across the river to bund it up.

8. Q. Have you ever absolutely lost all your crops?—No; we have never lost much of our rents. We have always managed to collect our full rents.

9. Q. What happens in those years when the Nepalese shut off the water?—We have big reservoirs. The reservoirs store up a large quantity of water and the Majowlie reservoir was constructed purely as a storage reservoir and has no direct connection with the river.

10. Q. (*Mr. Roberts.*)—Then, if they do make a *bund* any distance from your *bund*, there would be a certain percolation?—Not a drop of water would come through. Here it is clay.

11. Q. (*The President.*)—In years, when the Nepalese take your water, is your storage sufficient to pull you through?—It would not be, but they can only store the water for a month; and it never happens that we do not have rain sometime or other. We may have it in July and a break in August; that is enough

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to ruin any crop, but with the water stored up we can generally pull through.

12. *Q.* (*Mr. Muir-Mackenzie.*)—I suppose you never have less than 20 to 30 inches in any one year?—No.

13. *Q.* (*Mr. Roberts.*)—You have up to 63?—63 is our average. Sometimes we get as much as 80. In the last two years we have not had 50.

14. *Q.* (*The President.*)—That is hardly inside the famine tract. Was there any distress?—High prices and no labour among the poor people.

15. *Q.* Do you irrigate *rabi* as well as *kharif?*—Yes, I have watered the whole estate this year with canal water,—all the *rabi.*

16. *Q.* Practically every year?—Every year.

17. *Q.* (*Mr. Muir-Mackenzie.*)– Even in years of 60 inches of rain?—Yes. 20 inches may come in in one month; that does not help with *rabi.* I am positive that were it not for our irrigation, we should never have cultivated a third of our estates: we have such a lot of *usar* land—or as we call it 'rehar'—grows paddy with plenty of water, but would grow no other crop. It is not entirely *usar*, it is very bad poor land.

18. *Q.* You largely irrigate your rice?—Yes. We have to flood the fields.

19. *Q.* Generally September or October?—That is the most ticklish time. September is really the most critical time for rice. If we can tide over that, we get a bumper crop. I do not know that I have ever seen a fuller crop than we have this year. That was because I had this water and gave it a watering just as it was coming into ear.

20. *Q.* Have you had any year in which you have not found it of advantage to give water to your rice crop?—I have never had a year in which I have not had to use the canals for my rice crop, more or less. But last year I had 46 inches of rain at the end of June and in the first three weeks in July, and I did not use the water and did not let a drop of water go down the river: I stored the whole of that in my reservoir.

21. *Q.* (*The President.*)—Have you not these *bunds* silted up the channels?—No; only the surface 5 or 6 or 7 feet is of any use to me. All the rest is too low.

22. *Q.* You do not see any difference if it does silt up?—I have been there 29 years and I have not seen any difference.

23. *Q.* How many miles of canal have you going?—In 1889 when the settlement was made 110 miles in Birdpur estate, and these have been much extended since.

24. *Q.* That would require a good deal of maintenance?—Yes.

25. *Q.* (*Mr. Roberts.*)—You have had an engineering training?—Yes. In the other estates there must be more canals than in Birdpur in proportion to their size.

26. *Q.* That includes field distributaries?—Yes, anything two feet wide.

27. *Q.* (*The President.*)—Is your water delivered freely over the land or by lift?—All flush, except in *rabi.* I have never let them irrigate flush with *rabi*: I always make them lift that. I will not allow them to run it into the fields, because instead of doing good it does harm. It bakes the whole of the earth: the *rabi* gets overgrown for a few days and then all turns yellow and never recovers.

28. *Q.* You require them to lift the water over the edge of the canal?—Yes. Of course for rice it is flush.

29. *Q.* (*Sir Thomas Higham.*)—What happens to the embankments when you get a flood?—We pass the surface water through weirs, of which I have plans here.

30. *Q.* You sometimes have very big floods?—Huge. I once measured 22 inches of rain in one day.

31. *Q.* What is the width of the rivers?—The width of the biggest river is 100 feet.

32. *Q.* I suppose on low lands they cannot help having flush?—I do not allow them to open the canals.

33. *Q.* Where do they lift the water from?—From the canals which run through nearly every village. The tenants try to put every acre into rice cultivation. All the mango topes are now surrounded by paddy fields.

34. *Q.* (*The President.*)—Your *kharif* area is larger than your *rabi?*—We have very little *rabi* lands. The principal *rabi* lands are the rice seed lands.

35. *Q.* (*Mr. Muir-Mackenzie.*)—What other *rabi* crops?—Wheat and barley in the lands round the village itself.

36. *Q.* A great deal of the land is twice cropped?—Yes, especially the seed lands.

37. *Q.* (*Mr. Rajaratna Mudaliar.*)—Can you take a second rice crop?—No. They cannot use their rice seed land for rice: they keep it for *rabi.*

38. *Q.* (*Sir Thomas Higham.*)—Is there any rice not irrigated?—Only a little on the edge of the reservoirs.

39. *Q.* That you do not get so much rent for?—No.

40. *Q.* How much have these works improved the land? A great deal would not be cultivated at all otherwise?—No.

41. *Q.* (*Mr. Muir-Mackenzie.*)—There is plenty of drainage?—The canals act as drainage canals too.

42. *Q.* (*Sir Thomas Higham.*)—What average rent do you get an acre?—About Rs. 5-12 an acre for my best lands—thoroughly under the protection of the reservoirs, varying down to Rs. 3 and Rs. 4 per acre.

43. Q. In some years they do not want the reservoir water at all?– Not so much, but I have never known them not to want it for something.

44. *Q.* Do you make these channels?—I made them all.

45. *Q.* Is there any well cultivation?—I should say none.

46. *Q.* (*Mr. Muir-Mackenzie.*)—Are you the only people that have done this work?—No, there is a native, Babu Shurut Singh.

47. *Q.* Is his a large estate?—Yes, but not so large as this.

48. *Q.* It is a matter of considerable expenditure, I suppose?– Of course: but it has been spread over a great number of years.

49. *Q.* But it had been begun in a small way?—Yes, first in a temporary way in 1864 my father bunded up one of the small rivers and saved the crop: and then he started to make it permanent.

50. *Q.* Has Shurut Singh made his permanent?—Yes, he has copied ours exactly.

51. *Q.* Is it in process of being copied all over the district?—No.

52. *Q.* Is it too expensive?—The great drawback is that there are not these big estates. It would be impossible too, because two or three individuals with different interests will not club together.

53. *Q.* (*Mr. Roberts.*)- Your estates were grants originally of, for the most part, uncultivated land?—Yes, waste land given us.

54. *Q.* In that way you had a free hand, no tenants, no fights or anything?—Nothing.

55. *Q.* (*The President.*)—After the mutiny?—No, they were given out in 1844 in large tracts of forest and waste. First we tried indigo. There are five factories on these three estates, or the remains of them. That was found unsuccessful. There was lot of money spent: and then we turned it into an entirely zamindari. The population of Birdpur now is about 24,000. In 1853 it was 11,000: in 1865 it was 13,000 and in 1881, 23,000. So we are pretty well full up now. You cannot even make a small *bund* now, but your neighbour is down on you. I tried to get a clause put in the Rent Bill to enable people to have land for such purposes, but they would not have it.

56. *Q.* (*Mr. Muir-Mackenzie.*)—What was the objection?—We made these proposal that if a man should want land for this purpose, he could give compensation to the tenant or give him other land, but no such provision is made. It is impossible for people to do anything. Most of the tenants have occupancy rights, and you can do absolutely nothing. In one village of Gorakhpur the river broke and my land and others was covered with sand, and for two or three years we got little or no rent for them. The tenants could not pay, their crops never came to anything, and I had the greatest difficulty in getting the nullah embanked up. After two or three years I managed to persuade my neighbours to let me bund it up and now the crops have all righted again. But that is the sort of thing that ought to have been done by a Collector if he had authority for doing so.

57. *Q.* You would like the Collector to have authority?—Yes, and for Government to encourage him to go round and see if there is anything of this kind to be done.

58. *Q.* Giving compensation where necessary?—They laugh at the compensation when they see the benefit.

59. *Q.* But you have to do something to some unreasonable men. The Deputy Collector should be able to pay him out?—Yes.

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60. *Q.* Do you see any scope for Government enterprise in those parts where there are only small estates?—It is not only that. At one time the Nepalese objected to our *bunds*, and there was a commission appointed.

61. *Q.* Because they flooded the land behind?—Yes, and they would make the same objection now. Mr. Ricketts, my neighbour, in this last famine bunded up the Koora, a very big river, to save the crop. They sowed the *rabi*, but they did not manage to save their rice crop owing to the embankment not being taken in hand soon enough. That was only a temporary *bund*. I suppose it was 200 feet long, 125 feet base, with a depth of 16 feet. In a couple of months they dug 22 miles of canal. Of course they are all filled up again. They served their purpose for that year.

62. *Q.* Was there any flooding of the country behind?—They flooded back into Nepal. There is a very stringent order that no works on the frontier can be undertaken unless with the consent of both Governments.

63. *Q.* How far from the frontier?—So far as no harm is done.

64. *Q.* (*Mr. Roberts.*)—The difficulties with Nepal are greater now than when your *bunds* were begun 40 years ago, because since then there has been a large extension of cultivation in Nepal *terai*?—Yes. Our embankments were allowed on condition that no others were ever made on the frontier unless with the consent of both Governments. They tried all they knew to have our embankments destroyed.

65. *Q.* (*Mr. Muir-Mackenzie.*)—Apart from your embankments, supposing that Government brought a large canal through that district from the Gunduk, or anywhere else, would the water be taken?—I have no doubt that it would. In a rice-country they would always take water.

66. Q. You get your revenue only from your tenants' rent? You have no water-rate?—We amalgamate the whole into one. I know exactly what each village is capable of paying and assess it accordingly.

67. *Q.* Do you assess on the village or on the individual rayat?—I make a rate for the village irrespective of the status of the tenant. All my villages are divided into parcels of from 50 to 300 acres each. I give them out to a lessee, and he gives them out to the tenants.

68. *Q.* If advances were freely given by Government, would the smaller cultivators be induced to make improvements of this kind?—I do not see how you can expect them to. They have such small holdings.

69. *Q.* Can they not have small *bunds*?—They have so far as they can.

70. *Q.* Would not they do more with advances of money?—I do not know that they would. The zamindars are small. There are two or three in a village of from two to three hundred acres.

71. *Q.* There are disputes about what you have a right to do. Are you sometimes stopped in bunding up a particular stream?—Yes, if they have a right.

72. *Q.* Do you ever have to go to Court about it?—I never have, but they do.

73. *Q.* Would it be an advantage if the Collector were allowed authority about disputes?—I think it would be the greatest benefit. My own fellows often object to my doing certain improvements, but I never heed them and make it, and when they see the benefit they are glad. There was one point you asked the last witness about what security a tenant could give. If you gave the zamindar a lien on his holding, I am sure he would give security at once. A man has got an occupancy right. If you lend him money, and he does not pay, make over the holding to the zamindar. The tenant, in 99 cases out of 100, would pay. But that is the only security he can possibly give.

(*Mr. Roberts.*)—It was proposed to make occupancy rights transferable to the landlord, but the landlords objected and they could not carry it through.

74. *Q.* (*Mr. Rajaratna Mudaliar.*)—Have you any objection to giving the tenant the power of alienation of occupancy rights?—Most certainly. Why should he sell? That is not what he got the land for.

75. *Q.* In other presidencies he has the power to sell?

(*Mr. Roberts.*)—Fixed rate tenants have the power to sell.

76. *Q.* (*The President.*)—You have heard a good deal of the evidence and know all about this country. Do you think it is sound reasoning, keeping canal irrigation out of Oudh?—I know nothing about that. I have no experience of Oudh.

77. *Q.* It is rather remarkable. There is canal irrigation across the Ganges. Oudh says—"It must not come here." There may be some sound reason for that?—In *rabi* country I do not think it is so necessary as in a rice country.

78. *Q.* (*Mr. Muir-Mackenzie.*)—In Bengal they told us it is not good for a rice country?—Over and over again I have saved my crop in September.

79. *Q.* Have you ever had a good crop when your neighbours have had bad ones?—Yes. This year for instance. I have the biggest crop we have had for years; last year we had also a magnificent crop; in 1901 the rainfall was 49·47; in 1902, 43·32 inches.

WITNESS No. 30.—MR. J. J. HOLDSWORTH, C.I.E., Grantee of Lehra Estate.

Mr. J. J. Holdsworth.

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1. *Q.* (*The President.*)—Yours is a district where well irrigation is the main thing?—I have 36,000 acres in Gorakhpur and 5,000 in the Basti District. I have carried out the same scheme as Mr. Peppé, but Mr. Peppé has a perennial stream. The water in my reservoir is rain water only, collected from small nullahs that run during the rains. From this reservoir I irrigated about 15,000 acres.

2. *Q.* You have the same big weirs?—Yes. This year there was no late rain at Lehra, and had it not been for the reservoir a quarter of the *rabi* lands would have remained unsown.

3. *Q.* Are you as near the Nepal Frontier as Mr. Peppé?—No; about 15 miles in a direct line.

4. *Q.* You have not the same difficulty with the Nepalese?—No; the reservoir is practically in my own estate. It is about 500 acres in extent; there are 20 sluices gates, 5′ × 5′; the water goes back beyond my estate to the extent of about another 200 acres, and the water is taken by the neighbouring zamindars who gladly give up their land for the benefit of the storage of water by my *bunds*. I have a large number of wells on the estate from which the *rabi* crops are irrigated, and I have found that well water is the best for *rabi* irrigation; my father-in-law, Mr. Bridgman, got the Grant of Lehra Estate in 1833; at that time it was all jungle and grass land. We build wells six feet in diameter at a cost of about Rs. 100. The water-level is about 15 feet below the surface. A well will irrigate about 20 acres.

5. *Q.* How many buckets?—Two are generally used.

6. *Q.* That is practically only for the *rabi*?—Yes. The rice lands are irrigated entirely from the reservoir. I have a number of small reservoirs from 10 acres up, made by running *bunds* across small rain streams with escape gates at each end. I give bricks at cash price and lime free to any tenant wishing to sink a well, or if he prefers to make his own bricks, he gets the wood free; in most cases the tenants prefer to build the wells themselves; I also in all cases supply wood for the well curb.

7. *Q.* Do you go to the Collector for advances?—No; any necessary advances are made by me. I believe in wells, and *kachcha* wells may be sunk for Rs. 50 or 60 without lime; if our special well brick is used, we dig from 15 to 20 feet to place the well curb.

8. *Q.* (*Sir Thomas Higham.*)—How much will your reservoirs protect?—This year I have irrigated from 15,000 to 16,000 acres of rice and *rabi* lands.

9. *Q.* Do you keep water running on the rice lands from these reservoirs?—Yes.

10. *Q.* What is the rice area?—I suppose about 15,000 acres; the rice cultivation increases every year.

11. *Q.* I suppose you require 2 or 3 inches of water on the *rabi*?—The *rabi* crops are generally irrigated twice.

12. *Q.* It is sown on the rainfall?—Yes, in most years; but as there was no late rain this year, the land had to be irrigated before it could be sown. In 1896 and in 1897-98 owing to the failure of the rains, I should have lost a large number of tenants had it not been for my reservoirs which supplied them with water and kept them running away to Nepal. Part of Mr. Bridgman's estate reverted to jungle again, so many tenants having left, but since I started the irrigation works it has all been brought into cultivation again.

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13. *Q.* The people in your estate never have to go on relief works?—In 1873-74 the Government started a relief work by raising the main road to Nepal, a portion of which runs through the estate. Had I not established my irrigation works, I should certainly have had to apply to Government for relief work at some time.

14. *Q.* Do you charge anything for water?—No, nor do I increase the rent when wells are sunk either by the tenants or by myself. I have still some forest land, and a portion of estate is surrounded by the Government forest, and if I were to raise the rents, the tenants would leave, as they have great difficulty in preventing their crops from being grazed down by the wild animals; my very best land is Rs. 2-6-0 per acre.

15. *Q.* That has water?—Yes.

16. *Q.* (*Mr. Roberts.*)—It used to be a regular practice to bund up little nullahs right away up the Pawa?—Yes, but they were not kept in repair.

17. *Q.* (*The President.*)—There is a big canal being dug on the other side of the Gandak by the Bengal Government; is there room for a similar thing on your side?—I had serious thoughts of trying to tap the Rohin river, but it would be a large undertaking. I think Government might do a lot of good there.

WITNESS No. 31.—MR. G. P. GARTLAN, Agent for a Rae Bareli estate.

Mr. G. P. Gartlan.

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1. *Q.* (*The President.*)—Yours is a district where well irrigation is the main thing?—Yes.

2. *Q.* Is anything else needed to protect that country from famine?—Extension of the wells would be quite sufficient.

3. *Q.* You could not rely on *jhils* in a bad year?—For rice land we could not, and wells would not save the rice. In ordinary years the *jhils* are quite sufficient; in a year of drought they are not; wells do for *rabi* and *kharif* both, but mainly for *rabi*.

4. *Q.* Do you consider that a canal would be a positive harm to the country?—I have had no experience of canal irrigated land.

5. *Q.* Across the Ganges Canal irrigation is taken up everywhere?—The talukdars object to the canals, because they do not want interference with their tenants. It is not a question of the benefits of the canal, because there are places where it would be beneficial.

6. *Q.* Did you see any severe distress in the famine seasons?—Not in Rae Bareli, except in rice districts.

7. *Q.* Was there any relief in Rae Bareli?—Yes, on roads.

8. *Q.* Do the cultivators get a *rabi* crop off any field after rice?—*Jarhan* rice lands will not give a second crop often, even with watering.

9. *Q.* What about *takavi*? Do the zamindars or *kashtkars* readily apply?—It is with great difficulty they get it. They are put to much trouble, and they have to pay over 10 per cent. for it.

10. *Q.* (*Mr. Roberts.*)—Who gets it?—The *kanungo* who is sent to make an investigation gets something. The man who distributes the money gets something, and the *amlas* get something. The *patwari* probably gets something too.

11. *Q.* Do you really think it amounts to 10 per cent. for large advances to dig wells?—Not for anything under Rs. 100.

12. *Q.* But advances for *pakka* wells would scarcely be less than Rs. 250?—I expect he would pay 10 per cent. on that, because he does not get it in one lump sum. Every time he goes to get his 50 or 30 rupees, he has to pay. I have heard this from people who have paid it themselves. There are very few advances made in our district for wells; they manage to get the money for wells elsewhere. If the talukdars and zamindars did not interfere with the people, they would dig many more wells; but the landlords will not allow them, because they are afraid of the tenants getting a right.

13. *Q.* (*Mr. Roberts.*)—Big or little landlords?—Both.

14. *Q.* A very large talukdar whom we have examined says that he never refuses permission?—They may say so. They want a *bazdawa*, or adandonment of claim for compensation, but under the Oudh Rent Act that is waste paper.

15. *Q.* (*The President.*)—Is there any way of promoting the construction of wells?—Yes, I make advances to my tenants who are willing to make wells and charge them a certain interest. I do not take back the money, but put it as a permanent increase on the man's land; and the Court of Wards has been doing the same thing for the last few years on my suggestion.

16. *Q.* You practically pay for the well and get an increased rent?—Yes.

17. *Q.* You find that that system works well?—Yes.

18. *Q.* If something of that sort were introduced, would it be popular?—It would be popular among the people building wells, not among the landlords. But still the landlord would have no reason to complain.

19. *Q.* He has a right at present to forbid a well?—No, he cannot prevent it. If he will not allow it, the tenant can go to the Deputy Collector and get an order for the well to be built; and if the talukdar will not build it, the tenant is allowed to do so; and if the landlord ever interferes, he has to pay compensation for the capital spent on it.

20. *Q.* (*Mr. Muir-Mackenzie.*)—But it is not good enough for him to bring himself into bad relations with the landlord?—No.

21. *Q.* (*Mr. Rajaratna Mudaliar.*)—Are the rules understood by the tenants?—Partially. Some know them better than the vakils.

22. *Q.* (*The President.*)—Do you find that the rate of Government interest for advances is complained of?—No; but when all the commissions are added on, it comes to more than they can get it for in the open market.

23. *Q.* (*Mr. Roberts.*)—Can you suggest any way of stopping that leakage?—If you put the interest of the money advanced in increased rent and let that come direct into the Government treasury as revenue, that would stop it.

24. *Q.* (*Mr. Muir-Mackenzie.*)—Not take back the money?—No.

25. *Q.* But the leakage would go on when the money was being distributed?—For a time, but there would not be the same leakage. Now the man pays not only when he gets the money, but when he repays it. Wells can be built much cheaper by the *kashtkars* than by anybody else, even *pakka* wells.

26. *Q.* (*Sir Thomas Higham.*)—You do not think that canal irrigation is required at all in your own estate?—I do not think so.

27. *Q.* Is the whole area commanded by wells?—Almost all the *rabi;* not the rice. There are lakhs and lakhs of money invested in wells; and if the canal came, the wells would be nowhere.

28. *Q.* Does the rice depend on the rainfall?—And on irrigation from the tanks. The September rice generally comes round with the rain alone, but the *jarhan* rice requires to be irrigated.

29. *Q.* If a canal were introduced, it would not increase the value of your property very much?—I do not think so.

30. *Q.* Are they going on making wells?—Yes, year after year in my district. The Opium Department give them great assistance.

31. *Q.* I suppose the opium agents go out amongst them?—Yes, and there is not the same amount of bother in getting the money as with Government advances. The only charge they have is the investigation as to whether the man is fit to build a well. He has not to go to *kanungos*. I am not sure whether they charge interest 6¼ per cent. I believe repayable within two years.

32. *Q.* I suppose on all the wells of the Opium Department they grow a good deal of poppy?—But that is only a fourth of the irrigation from the wells.

33. *Q.* Do the Opium Department make them undertake to grow so much poppy?—No; he cultivates a *bigha* of opium. He is not obliged to cultivate more when he accepts an advance. But he must cultivate some. It is only in the case of his being a poppy-grower that he gets the advance. After one or two years he can give up poppy, and the Opium Department can do nothing. But it does not matter, for they have their advance back.

34. *Q.* Is there much poppy in Rae Bareli?—I suppose it is the best district in the country for poppy. They can get something like 15 or 16 seers from the acre. It is Rs. 6 a seer and Rs. 8 a *bigha* advanced on the land sown with poppy.

35. *Q.* You were in Rae Bareli in 1897?—Yes, I have been there 36 years.

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36. *Q*. How did you get on?—All the crops were fairly good except the rice.

37. *Q*. Was that the worst year?—Yes. In 1877 it was bad, but only for rice.

38. *Q*. Is rice a large proportion?—No, but it is very localised. Where it is rice it is all rice, and thus it suffered very much.

39. *Q*. They had a considerable number of relief works?—Yes, mainly from rice districts, but not all Rae Bareli people.

40. *Q*. Do not the people who grow rice grow *rabi*? —Yes, but on a very small scale. The *rabi* is very poor. I believe the wells are all right in an emergency. The people believe very much in *pakka* wells.

41. *Q*. They were very bad in Sitapur in the famine?—They have very few wells there, and it depends on the distance one has to go to get water. In Rae Bareli we do not look upon the well as the unit of irrigation; we look upon the bucket, and it is the same irrigating from a tank the *doogla* or basket is the unit.

42. *Q*. All the tank irrigation is done by lifting?—Yes.

43. *Q*. (*Mr. Muir-Mackenzie.*)—You said that if a canal were brought into the district, all the capital expended on the wells would be lost. Why? The people need not use the canal?—They have to pay for it.

44. *Q*. Not unless they use the water?—If they did not use the water, they would be subject to much more inconvenience by the irrigation people to force them to use the water. One man might use the water and another might not. It would be very easy to have disputes as to whether the other man actually used it or not.

45. *Q*. But his using the well, which would be evident, should save him?—That wolud not always save him.

46. *Q*. Do you mean to say that there would be false cases?—Yes, a very fine opportunity for people to start false cases for the ordinary revenue people, the police, the zamindars.

47. *Q*. Admitting that a great evil, still would it be such as to make the people all give up the wells on which so much capital has been spent?—It would depend on whether the water-level would be changed or the country water-logged.

48. *Q*. The rice crops did suffer in the famine year very much?—Not the *kuari* crop. The *jarhan* crop did suffer; in fact, it was a total failure.

49. *Q*. If you had a canal in the district, could you have saved that crop?—Yes, wherever the canal water went the crops would necessarily have been saved.

50. *Q*. At any rate, might we take it that the loss of that crop led to the necessity of relief in the district?—Yes, I should say it was owing to the loss of the *kharif* crops and dear grain.

51. *Q*. Now, if Government is to advance money for wells, it is bound to do it largely to the tenants?—Largely to the tenants and to the petty zamindars.

52. *Q*. How are the tenants to give security?—If you get the interest of your money from the land, I should say that is quite sufficient security. Of course you would have to find out whether the land was worth that or not.

53. *Q*. The tenant has no transferable interest in the land?—No.

54. *Q*. (*Mr. Roberts.*)—How is the Government to collect it?—The Government, instead of taking back the advance, would charge an extra rent and recover it from the tenant direct as revenue.

55. *Q*. That tenant at the end of seven years is ejected, what happens?—But you could always provide for your interest; the interest would always be a lien on the land. "An anna on the rupee" is merely a local saying; the rent does not depend on that "one anna in the rupee."

56. *Q*. You would have to collect it direct from the tenant?—Yes; or if the landlord was willing, you could collect it from the landlord like canal rates. The only drawback that there is to well irrigation is the expense of it.

57. *Q*. (*Mr. Muir-Mackenzie.*)—You do not think to save that expenditure the rayat would be glad to have a canal?—The rayat would, but the question is whether his land would suffer from it or not. The report is that the land does suffer from it.

58. *Q*. (*Mr. Rajaratna Mudaliar.*)—According to your proposal to levy a small additional rent upon the tenants' land, Government would be practically the owner of the well?—Yes.

59. *Q*. Would you then throw the responsibility of keeping a well in repair upon the Government?—I should say, if the zamindar become liable as Mr. Roberts mentioned for the extra charge, the zamindar would keep it in order. If he did not, and if it were merely the tenants, then, if you want to keep it in repair, the Government must look to it.

60. *Q*. Would it be possible for Government to do it?—I do not think it would.

61. *Q*. Does not your system then break down?—It may break down where the Government is concerned, not where the zamindar is concerned. That particular well does not secure one tenant's land; it secures the land of several tenants. If I give an advance to a man for a well and that gives him Rs. 8 increase on his rent, I get much more than that. That well does not irrigate one tenant's holdings; it irrigates several tenants' holdings, so that instead of getting 8 per cent. for my money, I may be getting 15 per cent. or 20 per cent.

62. *Q*. (*Mr. Muir-Mackenzie.*)—Do you think, as a matter of fact, if the well was a good one, that the tenant's interest in it would not be such that he would keep it in sufficiently good repair?—I certainly think so. He would be very sorry to let the well get out of order, because, if his irrigation came to grief, he would come to grief too and would not be able to pay his rent.

63. *Q*. (*Mr. Roberts.*)—Have you any other special things you would like to bring forward?—You do not seem to inquire about the rate of irrigation from wells or tanks. You were asking a witness this morning about the Cawnpore wells. That is all very fine for Cawnpore where they have got a *pakka* level water-supply from the canal. That kind of Persian wheel can only be worked at a certain level. You could not work that upon a *jhil*. If the *jhil* goes down five inches, it will not work. Then, again, I should like to speak about the proportion of cost of a well and the outturn you get for it. That depends if the amount of money spent on a well can be recovered from the rent, a tenant will build a well, otherwise he won't. There are such different soils you have to sink wells in. In Rae Bareli you have to go down sometimes 75 feet; in Sitapur and Gorakhpur you get water about 20 feet. You do not get that in Rae Bareli; the water-level in some places there is as much as 36 or 38 feet, and you have to dig down another 36 or 38 feet to get down to the genuine water spring, the *moosra* as it is called.

64. *Q*. (*Mr. Rajaratna Mudaliar.*)—Are boring instruments used in any of your villages?—Not that I know of. They are of no assistance to us. We know all the country around and the only thing they can tell one is what sub-soil there is below.

65. *Q*. (*Mr. Roberts.*)—Would the professional well-sinker be able to tell you the depths you have got to go down to?—We all know that, as a general rule, there is not a square mile—or, for a matter of that, half a square mile—in the whole of Rae Bareli in which there are not half a dozen wells.

66. *Q*. (*The President.*)—But the services of the professional well-sinker in Cawnpore are often requisitioned?—But he is always successful.

67. *Q*. (*Mr. Muir-Mackenzie.*)—He said that mostly all his cases had been successful?—But he does not tell you what his success has been in wells that have been built.

68. *Q*. (*Mr. Rajaratna Mudaliar.*)—How long does a *pakka* well last?—If a *pakka* well is properly built with small bricks, 50 years would be about an average. If they are built with big bricks, they do not last so long; they are liable to damage very soon.

69. *Q*. (*Mr. Roberts.*)—What do you mean by small bricks?—The ordinary small bricks, 10 inches by 5, something smaller than Government bricks.

70. *Q*. (*The President.*)—I thought *pakka* wells often lasted for a hundred years?—I dare say they do; but, as a rule, 50 years would be a very good average, because several wells do come to grief, either because the people have been using bricks insufficiently burnt, in which case they collapse, or else they have not sunk the wells deep enough, and in a dry year when they want to sink it further down, the curb sinks further down and the well collapses.

71. *Q*. (*Mr. Muir-Mackenzie.*)—What do they do then? Do they replace it with another well?—If the well entirely collapses, they build another well if they can afford it. I have lost two or three wells myself, and have had to replace them.

72. *Q*. You take 50 years as the average life of a well?—Yes. I should say that 50 years is an average you could depend upon.

TWENTIETH DAY.

Jhansi, 3rd December 1902.

WITNESS NO. 32.—MR. H. J. HOARE, Settlement Officer, Lalitpur.

Mr. H. J. Hoare.

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As my opinion is that canal or tank irrigation is impracticable in the tract of Bundelkhand, with which I am best acquainted, it is superfluous for me to answer the questions in detail.

My qualifications for the expression of an opinion are that I was Settlement Officer of Lalitpur in 1896-97-98, and in the cold weather of 1898-99 I inspected much of the black soil part of Jhansi, revising the settlement demand.

Lalitpur is the poorest part of Bundelkhand. It may be roughly divided into—(1) a black soil tract in the south; (2) a red soil tract in the north in which the natural soil is some of the poorest in the Provinces. A supply of water would be possible by creating a large *bund* on the Betwa similar to that at Parichha in Jhansi. The objections to canal irrigation are:—

(1) That such irrigation is not required in the black soil tracts in normal years, and that the cost of maintaining the *bund* and distributaries to be used only in years of scarcity would be disproportionate to the good conferred by partial immunity from famine.

(2) The red soil tract has numerous wells which cost only Rs. 60 apiece to construct, and, with repairs, are practically permanent. The country is too sparsely populated to provide the necessary manure and labour to cultivate spring crops with canal irrigation in land at present unirrigated. Irrigation without manure would be useless in consequence of the poverty of the land. At present scanty *kharif* crops are sown for three years without manure, and then the land is allowed to remain fallow for four or five years.

(3) The country is extremely undulating and intersected by an infinite number of nullahs which become small torrents in the rains. The cost of constructing distributaries would be colossal, and the difficulty in protecting them in the rainy season proportionally great. This remark applies to both the black and red soil tracts.

My remarks on the unnecessary character of canal irrigation in black soil tracts applies to the black soil tracts of Jhansi, and my remarks on the difficulty of distribution of water, also to the black soil tracts of Jhansi, but to a modified extent.

The second point for discussion is tank irrigation. My opinion is that small *bunds* are very beneficial, but they come under the scope of *takavi* allowances, not under that of the Canal Department. The cost of a small *bund* is anything from Rs. 10 to Rs. 500. The smaller *bund* are built with the object of providing a damp area in the bed of the resultant tank in which spring crops can be sown. The larger *bunds*, *i.e.*, the Rs. 300 to Rs. 500 *bunds*, probably furnish one watering to land below the *bund* before the bed of the tank thereby emptied is sown with spring crops. Most of the *bunds* constructed cost less than Rs. 100, and are usually made from *takavi* advances.

Large *bunds* and resultant large tanks do not, in my opinion, give a proportionate return on the capital expended on them, as wells are comparatively so much cheaper because the area irrigated from a large tank in the red soil tract is very circumscribed owing to difficulties of distribution. In the black soil tract irrigation from large tanks is not resorted to. Under the *bund* a considerable area usually bears a double crop of rice and spring crops consequent on the infiltration of water from the tank, and in times of extreme drought, such as 1897, the presence of a large tank guards against a water famine.

As a concrete instance the Bant tank *bund* in the Lalitpur sub-division black soil tract cost Government Rs. 30,000, I believe, to construct. The consequent increase in tenants' rental in the village has been perhaps Rs. 300 a year—to take an outside figure. Ordinary annual repairs are, I believe, about Rs. 300 a year, and occasionally a special grant is needed.

When a large famine work was exhausting ordinary wells in the black soil tract after a single day's use I found that the wells in the neighbourhood of the Bant tank did not give out, as they were supplied by infiltration from the tank.

This benefit of big tanks is, however, somewhat indirect.

They are impracticable on the score of expense.

I am answering in detail from memory the questions in Part E. These replies refer to red soil tracts only.

Question 34.—(1) Sixteen to 18 feet, shallow enough to permit of the use of Persian wheels, which are general.

(2) *Springs.*—Water was scarce in 1897 and the crops had to be stinted, but the wells did not fail, nor was the irrigated cropped area reduced by more than 20 per cent.; in an ordinary year there is no fear of failure nor of becoming saline.

(3) Rs. 60.

(4) Fifty years with repairs.

(5) Persian wheel.

(6) Two and a half to 3½ acres.

(7) Two and a half to 3½ acres. The same area is irrigated year by year.

Question 35.—(1) Two crops instead of one.

(2) The unirrigated crop is a poor *kharif* crop, *kodon* or *tilli*. The irrigated crop is *sáma*, or *phikár* or maize followed by wheat or barley.

(3) (*a*) No comparison is possible, the crops being so dissimilar.

(*b*) No comparison is possible, the crops being so dissimilar.

(*c*) In a year of drought the unirrigated crop would be absolutely destroyed, as it is a late crop.

The *sáma*, *phikár* or maize would give a deficient yield. The wheat or barley would probably be 20 per cent. under average owing to shrinkage in area and stinting in water.

Question 36.—(1) Normal history of unirrigated field of one acre is cultivated for three years and fallow for five.

	Yield.
1st year	5 maunds *kodon.*
2nd "	10 " "
3rd "	7 " "
4th "	*Nil.*
5th "	"
6th "	"
7th "	"
8th "	"
8 years' yield = . . .	22 maunds *kodon.*
1 year's yield = . . .	2¾ " "

	Rs.	a.	p.
2¾ maunds of *kodon* is worth . . .	2	8	0
The irrigated land yields at *kharif* 5 maunds maize, worth, say, Rs. 9: at *rabi*, 5 maunds wheat, worth, say, Rs. 2-8-0 per maund = Rs. 12-8-0: total value of year's produce . . .	21	8	0
Excess over average unirrigated area .	19	0	0
(2) Value of—			
Unirrigated field		*Nil.*	
Irrigated "	16	2	0

(This is at ordinary prices; at famine prices I should say Rs. 27.)

Question 37.—(1) The cultivator builds his own well and holds the irrigated land at dry rates for 2½ or 3 years. Full rent rates are then imposed. The dry rate may be taken as Re. 1 per acre and the wet rate as Rs. 4-8-0. So Rs. 3-8-0 is the rate of rent paid on enhancement, and ultimately Rs. 1-12-0 per acre, the

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ultimate enhancement in revenue. The rates are paid on the area actually irrigated, *i.e.*, three acres.

Question 38.—(1) Yes; the selection of a spot to dig a well is absolute chance work. I have been asked several times to indicate a spot for a well to test the *sahib's* luck.

(2) The difficulty encountered is rock which has to be blasted and broken through. No assistance has been offered except *takavi*. A dynamite depôt would be useful.

Question 39.—I am only in favour of *takavi* advances to build wells. I am not in favour of any scheme for increasing the population in such a barren land as the red soil tracts of Lalitpur. Irrigation is useless without manure, and manure presupposes large waste areas for the pasturing of cattle, as but little *juár* can be grown for fodder.

Question 40.—Temporary wells are scarce and can be dug in the beds of nullahs only. They are practically no protection against drought.

Well irrigation in the black soil tracts is not needed in ordinary years. Wells cost Rs. 200 each, and need to be masonry,—not *kachcha-pakka.*

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1. *Q.* (*The President.*)—You have been some years, I understand, in Bundelkhand?—I have been two years as Settlement Officer in Lalitpur and one year in Jhansi for revision of settlement.

2. *Q.* You say that Lalitpur may be roughly divided into a black soil tract on the south and a red soil tract on the north. What are the relative sizes? Are they equal?—The red soil tract is twice as big as the black.

3. *Q.* Does the black soil include both the *mar* and the *kabar*?—Both. It comes under the same name of *moti* in Lalitpur. It would not be worth while to classify it into *mar* and *kabar*, as rents are so low in the sub-division.

4. *Q.* Are these very difficult?—The *mar* is difficult to distinguish when it approaches *kabar*. True *mar* is to be found in few places in Lalitpur.

5. *Q.* You say that irrigation is not required in the black soil. Both *mar* and *kabar*?—Yes.

6. *Q.* In the Betwa Canal they have taken water for the *kabar* in 1896-97. They are going on freely ever since?—I have left the district now three years, and my inspections did not lie in canal irrigated villages to any large extent, but I saw, when I was inspecting, kabar being watered from the canal.

7. *Q.* One's experience elsewhere in India is that an impetus is sometimes given in a dry year, and they go on taking the water afterwards?—Especially if they manure the *kabar*. It would change its class to a certain extent. Manure would bind it closer together and render it more favourable to irrigation.

8. *Q.* You say "such irrigation is not required in black soil tracts in normal years; the cost would be disproportionate." But of course that depends on whether they get into the habit of using it steadily every year. Take, for instance, the Sone Canals. For a long time they held off the water except in a dry year, but now, if the Sone canals were double the size, they would take the water?—Is the Sone country *mar* and *kabar*?

9. *Q.* I cannot say, but a country provided with a fair amount of rain. You say "the red soil tract has numerous wells, which cost over Rs. 60 to build"—*kachcha* of course. How deep is the water surface?—About 20 feet down. They are worked by Persian wheel and lined with sun-dried bricks held together by mud.

10. *Q.* You say "irrigation without manure would be useless." A piece of evidence given us by Mr. Ferrard, who was in Banda, states: "A marked feature of Banda is the large amount of black cotton soil. I do not think, taking the tract as a whole, canal irrigation would be beneficial, profitable or extensively used. It would lead to an extension of rice cultivation in ordinary years with the greater assurance it would give." Do you agree with that? You say "at present scanty *kharif* crops are raised for three years without manure"?—I do not quite know where the rice would be grown. I have never seen it growing on true black soil, either *mar* or *kabar*. I do not think that the soil would suit the growth of rice. I do not think that, with the aid of two canal waterings, they could grow rice on black soil.

11. *Q.* You say "the country is too sparsely populated to provide the necessary manure." Mr. Ferrard says "Banda is pastural as well as agricultural, and cattle-dung is fairly plentiful. The silt of tanks is also used as manure." I take it that the tract is not badly off in that respect?—It would be the same in Lalitpur, but cultivation would have to be very largely increased to repay canals, and then there would be a dearth of manure, because the cultivation would encroach on the grazing grounds.

12. *Q.* But we have always to consider the amount of money that may be spent on famine, and even if irrigation is only availed of once in four years, it is possible that in that time a great deal more money than the canals cost might be spent in famine. We are not looking for irrigation to pay 4 per cent. like the Ganges Canal or those of Upper India. I see you advise "small *bunds*"?—For the black soil and also for the red soil tract. A small *bund* would cost 10 to 20 rupees, and water would lodge there in the rains, and in black soil tracts that would fertilize the land on both sides of the *bund* by percolation, and by the water actually lying in front of the *bund*. But in the red soil tract the water held up would be distributed for irrigation, so that they are much more financially useful in red soil.

13. *Q.* We had a note sent to us by a former Commissioner of Bundelkhand, Mr. Ward, who strongly advocated *bunds* to arrest the denudation of the land, and for meeting the tremendous floods that come down and carry off all the soil with them?—The action of the floods is so wide that the number of *bunds* that could be constructed would have no appreciable effect on the denudation. It is practically universal in Lalitpur. There is an enormous number of torrent beds running through the sub-division. Each one of these denudes the land to some extent.

14. *Q.* Would it not require something more than small *bunds* and a series of tanks?—The question of these torrents is so wide. We cannot go a mile across country without coming across one of these torrent beds. I do not think that it could be affected by *bunds*, except on an enormous scale, taking it by villages and making a series of *bunds* in each village.

15. *Q.* The land along the edge of these torrents is pretty well all denuded?—No; it is a wonderful thing that it is not affected more than it is. A few yards away from the torrent this denudation seems to stop. It does not break the adjacent land up into ravines as I have seen in other parts of the country.

16. *Q.* In the south of India there are whole chains of tanks in the same valley, which was presumably once a torrent bed?—I have seen it on a small scale, chiefly in red soil tracts.

17. *Q.* The small *bunds* you advocate are within the power of the landowner?—Or the tenant, to make from *takavi*.

18. *Q.* Is *takavi* freely taken advantage of?—Freely, but not freely given. Government is generally very close about giving *takavi* there. It is rather hard to realize, and the people have very small resources in the part I have been used to, and they have no conscience about applying that *takavi* to pay off their private debts, so that it is not safe to give to any but certain agricultural castes, who would certainly make use of it in the manner intended.

19. *Q.* Should not that be looked after; it is an important matter?—I think so. The ordinary difficulty is not in getting the *takavi* distributed.

20. *Q.* I suppose they do not complain of the interest charged?—No; the rate of interest has no effect whatever.

21. *Q.* I suppose they complain of the inexorable nature of the repayment?—That is distinctly complained of. It is the great point against *takavi* from the cultivator's point of view. There is no elasticity in the demand.

22. *Q.* You say "large *bunds* resulting in large tanks do not in many cases give a proportionate return on the capital expended, as wells are so much cheaper, because the area irrigated by a large tank is very circumscribed." Owing to the rough nature of the country you cannot get a large stretch of irrigation?—No.

23. *Q.* Your experience of the effect of these tanks or lakes is to supplement the wells?—Decidedly. I remember one particular case of famine work. I found that the wells gave out after being used for one or two days for water for the famine coolies. I moved on the famine work to the vicinity of a large tank and found that the wells there gave an ample supply of water.

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24. *Q.* (*Mr. Muir-Mackenzie.*)—Was there a tank holding water at the time?—Yes, near Bant, in Lalitypur sub-division.

25. *Q.* I suppose if other tanks were made in your sub-division, they would be likely to hold water?—I think so. The *bund* I refer to was a very fine one made in 1868, for Rs. 30,000; a good, big tank to hold water all the year round.

26. *Q.* You said financially they would not pay?—It raised rents from Rs. 1-4 to Rs. 2, increasing rents perhaps by Rs. 300 in all, and the total cost of repair comes to a thousand a year.

27. *Q.* Now that they take the water more freely, is there not a chance of it paying better?—I think they are allowed to take the water for nothing.

28. *Q.* (*The President.*)—You do not know how much water was held up in this tank which cost Rs. 30,000?—No.

29. *Q.* When you say that tanks are impracticable on the score of expense you give very strong reason in favour of tanks. "In the black soil tract irrigation from large tanks is not resorted to. . . . In times of drought the presence of a large tank guards against famine." A little after, "they are impracticable on the score of expense." You say the wells give out?—They do not absolutely give out, but the irrigable area is much contracted in a famine year for red soil wells.

30. *Q.* Would not good be done by digging them deeper?—I think not. It is probable that if they were dug deeper, the water would disappear altogether.

31. *Q.* Then a well is not a very sure thing to rely upon?—Decidedly not on the black soil. They were exhausted in the famine by simply drawing water for the coolies on the famine work, and for irrigation they would give out very shortly. There is no spring in the black soil well, simply percolation, and when the water is exhausted in that particular lie, there is no more available absolutely.

32. *Q.* Was there heavy distress here in 1896-97?—Yes, very heavy. We had three years of famine works.

33. *Q.* And the expenditure must have been very large?—Very large.

34. *Q.* What measures would you advocate to make the country better able to withstand a famine?—The only possible measures would be tanks, but I do not advocate them on the ground of expense. I do not think a canal would be possible in the black soil tracts in Lalitpur. There would be a great difficulty too in the levels. The whole country is a series of hog's backs.

35. *Q.* There is nothing for the Canal Department in Lalitpur?

(*Mr. Marsh.*)—We are thinking of making a supplementary tank through to Parichcha.

(*Witness.*)—That would not directly help Lalitpur; it would help the wells.

(*Mr. Marsh.*)—I do not think it would help the wells, because it is rocky and water-tight. There is no chance of percolation.

(*The President.*)—Not from any part of the tank?

(*Mr. Atkinson.*)—No, except immediately on the banks of the river; the influence would not extend to any distance. That I know from the effects of the actual Parichcha reservoir.

(*Witness.*)—My remarks with respect to the impossibility of constructing a canal apply to the black soil, not to the red soil. Black soil is chiefly affected in time of famine.

(*The President.*)—Mr. Atkinson, are these tanks which you propose to make to help Parichcha in black soil or red soil?

(*Mr. Atkinson.*)—In rock. Occasionally it is red soil in one tank and black in another; but it is more rock than anything else.

36. *Q.* (*The President.*)—Is there any rice grown at all in Lalitpur?

(*Witness.*)—Yes, most of it in red soil tracts. In these it is grown by a series of *bunds* made down nullahs; simple *bunds* made by the cultivators.

37. *Q.* For the improvement of these *bunds* would not water-storage for those tracts be a benefit? I do not mean pay financially?—Certainly.

38. *Q.* Is it a considerable area?—It is not large in comparison with the other crops.

39. *Q.* I suppose there is no sugar-cane?—Very little.

40. *Q.* Is cotton grown in black soil?—Very seldom in Lalitpur. White wheat is the great crop, but that has ceased since the outbreak of *kans.* Now they grow *juar.*

41. *Q.* Does it stand *kans* better than wheat?—Yes. When the land is affected by *kans*, gram and *juar* can be grown to a certain extent, but wheat cannot. But the only crop that will keep soil clear of *kans* is wheat, because they plough it so much more and cultivate it more carefully for the cultivation of wheat.

42. *Q.* You have had plenty of experience of *kans*.—Yes.

43. *Q.* Do you know of any way of getting rid of it?—Digging down to a depth of 12 feet, but the cost of that is enormous. A Kurmee did that in a village near Jhansi. I forget the exact cost to clear about 3 acres. I believe he had to spend Rs. 10,000, and he did it to grow *al*, and directly he cleared the three acres, the German chemical dyes came in and that Kurmee is now a cultivator.

44. *Q.* Very hard! Have you seen an experiment of killing *kans* by bunding a field three feet deep or so?—Yes, it is very effectual to drown it out. In the areas of tanks one never sees *kans.*

45. *Q.* Considering all this and the difficulty of *takavi*, would it not be worth while for Government to go in for *bunds* of that sort to improve the land?—The area affected is so small in comparison with the rest of the black soil. If the cultivators would use them for irrigation, then I think they might be financially successful to an extent to justify their being made, but not without irrigation.

46. *Q.* Is the area destroyed by *kans* large?—Enormous. It exists on all black soil, and directly the cultivation is relaxed on account of famine or otherwise, it begins to sprout. The best cultivators sometimes get it under, but in most villages it absolutely chokes up the ground for *juar*, and then the land has to lie fallow for 10 years.

47. *Q.* (*Sir Thomas Higham.*)—What is the Bant tank?—It was constructed in the 1868 famine. It has a large masonry escape constructed by the Public Works Department. It was a tank which had held water the whole year; always to a considerable depth. But now Mr. Silberrad says that they use the whole of the water for irrigation.

48. *Q.* They run it dry every year?—Yes.

49. *Q.* Is it kept in repair by Government?—Yes.

50. *Q.* Under the Public Works Department?—Yes.

51. *Q.* You say that there has been an increase of Rs. 300 a year in the rent. Is that due to the irrigation from it?—Due to the percolation. I do not know what has been the effect since they started irrigation.

52. *Q.* They would agree to a further increase?—I should think so.

53. *Q.* Would Government get any share in that increase?—Not until the next settlement.

54. *Q.* When will that be?—25 years hence.

55. *Q.* That increase was taken in the last? There has been a settlement since 1861?—Yes, about 5 years ago. I think the demand of Bant was unaltered. It was Rs. 1,700, and the change was not a hundred rupees either way.

56. *Q.* This increase in the value of the produce of an irrigated field that you give refers to well irrigation?—Yes.

57. *Q.* You construct a well and estimate that the increase in the value of the produce is about Rs. 13-10 an acre?—Yes.

58. *Q.* Of which Rs. 4-8 is taken in the form of rent?—Yes.

59. *Q.* So there is about Rs. 9 which represents partly the profit of the cultivator and partly the cost of the well lifting?—Yes.

60. *Q.* Supposing water were brought by a canal, would it not increase the value of the produce to the same extent?—Certainly.

61. *Q.* There would be no lifting to be done?—No.

62. *Q.* Government ought to be able to realize more than one or two rupees an acre; should it not?—Yes. I should not like to say exactly what they would pay for canal water there.

63. *Q.* They have paid for lifting well water. Why not pay for canal water?—Certainly they would pay, but I do not know the exact amount they would pay.

64. *Q.* I am looking at the low rate on the Betwa Canal. Do you think all irrigation would be useless

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without manure?—I think so, on the red soils. I do not think it would be useless on the *kabar*. If you can get them to take water for the *kabar*, it has sufficient richness in it to be cultivated by canal water, but not the poorer soil. *Purwa* can be also irrigated without manure.

65. *Q.* Where you have wells there is always a certain amount of manure. How do they blast their wells?—Gunpowder; chiefly country gunpowder.

66. *Q.* Is that done by everyone, or is there a professional well-maker?—Chiefly done by the people themselves. They understand fairly well how to use it. But they are very often unsuccessful. Sometimes the rock is too thick, and very often they do not hit water. When I was Settlement Officer they used to ask me to settle on a place to make a well.

67. *Q.* Have they ever tried boring?—No. The great difficulty is the bed of rock that is always met with in constructing a well.

68. *Q.* Do you know of any instance in which they have put a borer down the bottom of a well and struck water?—I have never heard of such a case.

69. *Q.* Do you know how many wells there are in Lalitpur?—No; I think there are no returns. Returns for the settlement were given of the masonry wells, and most of the wells are not masonry wells, —unbaked brick.

70. *Q.* When a well is made through rock, it does not want masonry?—No; only for a short distance at the top.

71. *Q.* Are not they shown as half-masonry wells in the settlement figures?—I think they are for masonry wells only.

72. *Q.* (*Mr. Muir-Mackenzie.*)—There are 18,000 half-masonry wells. You say (question 37), "the cultivator builds his own well and his rent remains at dry rates for 2½ to 3 years, and full rates are then imposed." By what authority are they imposed? —By agreement between the landlord and tenant. There is probably no Court work in Lalitpur between the parties. The landlord is strong, and the only limit on the landlord's rental is that the tenant will leave his village and go elsewhere, and there is a great demand for tenants.

73. *Q.* Does not that act so as to prevent the landlord getting any increase of rent?—It is a long established custom that the tenant should have 2½ to 3 years.

74. *Q.* Is there any remedy?—I think not.

75. *Q.* Does the existence of this custom deter the tenants from building wells or making improvements? —Undoubtedly. If the custom were not established, more wells would be constructed by tenants.

76. *Q.* Have you a clay sub-stratum?—No.

77. *Q.* Then in these wells in the red soil you have a bed of rock?—Yes.

78. *Q.* Is the bed very thick or only a lamina? You can get through?—Only a lamina, and below that is the water-bearing stratum.

79. *Q.* I suppose it varies very much in thickness?—Yes, in some cases they have to give up blasting altogether.

80. *Q.* A well-borer, furnished with proper machines, would be an assistance?—Yes, if he could get through rock.

81. *Q.* You think the cultivators would be glad to use him?—I am sure they would.

82. *Q.* I suppose you got through an enormous amount of *takavi* in the famine under one act or the other?—A very large amount, but not so much as we should have liked. Government did not give us so much as we should have liked.

83. *Q.* You were not so badly off as some other districts. You relieved 15 to 10 per cent. of your population; they were not worse off than Lucknow?—I think we were fairly badly off.

84. *Q.* In Jalaun there were 34·8 per cent. on relief, in Hamirpur 25 and in Banda 42. Why did not Jhansi require so much relief as the northern districts?—In Lalitpur I put it down to the amount of jungle fruits available for consumption, and the proportion of red soil to black is much larger in Lalitpur, and it is much larger in Jhansi too than in Banda and Hamirpur. Another thing is that the populat[illegible] is scarcer.

85. *Q.*—There is much waste in Jhansi?—Yes. Lalitpur has one acre of cultivation to five of waste.

86. *Q.* Are the people largely on these red soil jungle tracts?—No; jungle tracts are found all over the districts, chiefly near the reserve forests.

87. *Q.* In any numbers?—No, practically unimportant.

88. *Q.* Can you attribute this slight advantage of Jhansi compared with the northern districts to the larger number of wells?—The preponderance of red soil means a larger number of wells; I should attribute it to that and, to a certain extent, to difference of administration under the famine. Methods were less liberal in Jhansi and Lalitpur than in the northern districts.

89. *Q.* Would that account for very much? You could have got up to 25 under the same methods?—I think so. I think the famine was as severe in Jhansi as in Hamirpur.

90. *Q.* Canal irrigation seems to be of very litle use in the black soil, and the wells are not in the black soil. With reference to the embankments?—The most practical use I have seen is from the small *bunds*, from Rs. 10 to Rs. 15, built across a channel, with no masonry. That is for holding up water and fertilizing the area. The *bund* is opened in the cold weather when they wish to sow.

91. *Q.* With respect to small embankments, were any of these embankments made by famine labour?—A work costing Rs. 10 to Rs. 15 is of no use as a famine work.

92. *Q.* Government did not try to make these *bunds* as famine works. Would that have been practicable? —If Government had taken 3 or 4 villages in hand and made a large number.

93. *Q.* All *bunds* under the Public Works Department?—It would have been very useful.

94. *Q.* In future would you like to see embankments become a considerable feature of famine work?—The chief feature.

95. *Q.* The wheat in Bundelkhand is a good deal affected by rust?—Yes, whenever there is an excessively wet cold season.

96. *Q.* Do you not find ail wheat grown inside these embankments suffering excessively from rust?—I think not, unless the rains were excessive.

97. *Q.* Was the loss of cattle very great in the famine?—Not very great.

98. *Q.* Where did they get food?—They have the large area of reserve forest in the south.

99. *Q.* Where was the water famine worst in Lalitpur;—In the black soil?—Yes.

100. *Q.* (*Mr. Rajaratna Mudaliar.*)—As regards these embankments for famine relief purposes, do you think that the cultivators would allow them to be constructed anywhere where the famine officer thought fit?—No doubt. Most of them were made by the villagers themselves. I do not think there would be any objection on the part of the cultivators.

101. *Q.* That is, supposing they were not called upon to pay for them?—Yes. The relations between the officers and cultivators in Lalitpur are decidedly better than in any other part I have been to. They depend absolutely upon the official word.

102. *Q.* Would it be possible to work the system by handing over a certain number of coolies,—famine labourers,—to the cultivators themselves, the Government paying the cost? That would save supervision? —To work under the direction of the cultivator?

103. *Q.* Yes. The payment might be made by the Revenue Officers after inspection of the work once a week?—Payment once a week would be unsatisfactory in famine time. You must pay them day by day.

104. *Q.* Could not that system be usefully tried? There was a great howl in the Central Provinces owing to the embankments being constructed anywhere in places where they did not like?—The tenants should be very carefully consulted beforehand when the scheme is being prepared so as to have the bunds in the places they wished, but I should be sorry to leave the execution in their hands.

105. *Q.* As for the enhancement of rents on well lands, at the end of 2½ years or 3 years is there any protection for tenants?—None whatever.

106. *Q.* In spite of the Tenancy Act;—I refer to occupancy tenants?—Occupancy rights here are of a strange nature. They simply mean the right to hold certain fields and certain lands. The fixed rent idea has not yet been implanted in the Lalitpur tenant. The matter of rent is fixed between him and the landlord, and there is no difference between tenant-at-will and occupancy real rates. The tenant holds

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certain well-irrigated fields and certain other fields outside which can only be cultivated for three years and which are abandoned at the end of three years in favour of culturable fallow.

108. *Q*. Can he not appeal to the Collector?—It is always done by agreement. The Courts are never consulted. I do not think there was a single enhancement of rent case in the period of settlement, and very few of the determination of price.

109. *Q*. If a landlord constructs a well, do you allow him exemption in the settlement?—I gave a certain amount of compensation for wells at the settlement, but they were mostly constructed by the tenants.

110. *Q*. That was done even if he did not extend any compassion to his own tenants? How do you fix the area on which to grant the exemption?—That was rather a difficulty. As a matter of fact, it was chiefly granted on the cost of the well.

111. *Q*. We were told by some witnesses that the area irrigated in the preceding two years is entered as entitled to exemption. That is, supposing in one year 10 acres are irrigated and in another year 15 acres—25 acres are entered as entitled to exemption. Is that the rule?—No; the rule I generally followed was by giving a good percentage on the cost of the well; I found that the area was very difficult to calculate. I am doing the same in Farrukhabad. I find there that they build a *kachcha* well and then a *pakka* well. The same area has been watered before by the *kachcha* well, so that it is not an increase of irrigation. Similarly in Lalitpur the masonry wells made by the zamindars are very often on land which has been watered, perhaps from a tank, before or from a *kachcha* well. We could always get at a reliable estimate of the cost of the well.

112. *Q*. (*Mr. Muir-Mackenzie.*)—What is the water-bearing stratum?—Usually gravel with rock underlying.

113. *Q*. You got rid of a large amount of *takavi* during the famine. What was the machinery?—We gave a lot from the famine fund, which I distributed personally after enquiries of the people themselves; more free grants than *takavi*. It was mostly for seed and cattle. The amount for bunds was very small.

114. *Q*. For the purpose of this machinery I am not restricting my inquiry to any particular use. Any money that you wish to recover?—Inquiries were sent out to the tahsils for verifying security, and the joint responsibility of village bodies was also used as security for individuals in the famine year.

115. *Q*. Did you have to do with them first of all through the tahsildar, or did you go out and do all that on the spot?—Through the Tahsildars chiefly.

116. *Q*. Did not that occupy a lot of valuable time?—I do not think that it occupied as much valuable time as if European agency had been employed on that. I was in sole charge of the sub-division. My time would have been taken up entirely in these inquiries.

117. *Q*. Too many things to do, I understand that. But the tahsildar disburses the money?—Yes.

118. *Q*. Did they disburse the free grants also?—No; I disbursed those myself.

119. *Q*. In ordinary times, when there is not so much to do, might not time be saved if inquiries were made on the spot and the money disbursed on the spot by the Sub-divisional Officer?—Decidedly. He might distribute a lot of money on his tours.

120. *Q*. He would be able to inquire as to the feasibility of improvements and to urge the undertaking of them on the people?—Yes.

121. *Q*. These half-masonry wells, with a little brick at the top, then going through the rock, the lower part remaining unbuilt; how long do they last?—Practically for ever, with repairs.

122. *Q*. Given that the wells generally last for ever, do you think that the people would be induced to take advances more freely if they were given a long term, if the instalments were made repayable in 20 years? It would make the payment very minute every year?—I think it would encourage them to build wells.

123. *Q*. (*Mr. Rajaratna Mudaliar.*)—What is the average time at present allowed for repayment?—I think it is 12 years for wells.

124. *Q*. (*Mr. Roberts.*)—Have you given much *takavi* for wells?—As Sub-divisional Officer I did.

125. *Q*. Did you give it for 12 years?—I cannot be certain, but I think so.

126. *Q*. You are entitled under the rules to give for 15, but most of the Collectors told us 5 or 6 years. Over 15 years requires sanction. Your *takavi* was given to zamindars or to tenants?—Mostly to tenants. [*N.B.*—This answer refers to advances for seed and cattle,—not to advances for wells.]

127. *Q*. What security could they give?—If they had not anything, we used to take the security of their oxes, but we avoided their oxen as much as possible.

128. *Q*. That is a poor security for a loan of even 12 years?—The landlords sometimes want security.

129. *Q*. They are willing?—Yes.

130. Q. The cultivators in Lalitpur have mostly small holdings?—Yes.

131. *Q*. And the zamindars themselves are large cultivators?—Yes. They do not actually use the plough, but they cultivate through servants.

132. *Q*. *Khudkasht*. Do the zamindars come forward for wells?—Yes; they are keen on wells because of this system of taking increased rent after three years.

133. *Q*. You think that *takavi* for wells can be pushed in Lalitpur?—I think it is quite the thing to push.

WITNESS No. 33.—MR. H. J. BELL, Collector of Banda.

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1. *Q*. (*The President.*)—How long have you been at Banda?—Three years and two months.

2. *Q*. This Ken project affects your district?—Yes.

3. *Q*. What do you think of it from the famine protective point of view?—It will be of the utmost service.

4. *Q*. You suffered from famine very heavily?—Banda was the worst district in India in 1896-97.

5. *Q*. Is the scheme generally known in the district?—They know we have certain plans. We have had a Government officer there for two years.

6. *Q*. Are the zamindars keen about it?—Very pleased indeed.

7 Q. What is your soil?—In that part very largely *purwa*, and the canal is designed to serve that soil and to avoid *mar*.

8. *Q*. What proportion of that district will the Ken serve, 10 per cent.?—Half the area.

9. *Q*. How much of that country is black cotton soil, commanded from the Ken Canal?—Approximately about 35 per cent. *purwa* and *kabar*.

10. *Q*. What is your experience as regards the irrigation of black soil?—It is not known in Banda.

11. *Q*. Presumably, if it was not black soil, it would be irrigated?—There is not much irrigation in the light soils, but they could easily irrigate them. There is less irrigation in that than in any other in the provinces.

12. *Q*. Any wells?—Very little irrigation from the wells. There are plenty of wells.

13. *Q*. What is the reason?—The wells are very deep and there is a great deal of labour.

14. *Q*. How deep?—60 to 100 feet and deeper. And the people are not an industrious class at all. There is a high proportion of high castes, Brahmins and Thakurs.

15. *Q*. What happened to these people in the famine time; they died, I suppose?—They had very bad mortality indeed. We did not know how many died.

16. *Q*. Are there any measures in course of progress, apart from the Ken Canal, for fortifying Banda District in future?—Yes, Mr. Barlow has proposed some.

17. *Q*. Mr. Barlow says that it is very difficult to suggest suitable works for the irrigation of the district if the people will not use wells?—Where the people can irrigate they will not. They are very idle; they will not irrigate from tanks often.

18. *Q*. Will they irrigate when they get the Ken Canal?—It is very problematic. I do not see why they should not.

19. *Q*. (*Mr. Muir-Mackenzie.*)—There is unsuitability in the soil?—Not in the soils which a canal will serve.

(*The President.*)—The discharge of the [illegible]er in Banda is very small.

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(*Mr. Muir-Mackenzie.*)—It is very remarkable. Here he says that Rs. 32,91,000 were spent on relief in the Ken district and the cost of the works is only 30 lakhs. If it gave anything like protection, it would almost pay to give water for nothing.

20. *Q.* (*The President.*)—You propose a small reservoir at the head of the canal. Are there any lakes or tanks?—No. There are plenty of village tanks, but no large tanks as in Hamirpur.

21. *Q.* Has the place ever been prospected with a view to large tanks?—Mr. Barlow was pressed for a time last year and could not go into it so thoroughly as he would have liked.

22. *Q.* Where are you as regards things being better than last time?—I do not think it is much better. There have been a lot of bunds put in, and a few extra wells have been dug and few more tanks made. But it is not much stronger than it was before.

23. *Q.* Are there any means by which it could be made better?—Yes. I attach very great importance to embankments.

24. *Q.* Small embankments made by the cultivators themselves, or on a larger scale?—Both.

25. *Q.* Is there much of it existing?—Yes, a good deal.

26. *Q.* The people understand it?—They understand the idea of it, but are not very skilled in construction, except in the smaller ones.

27. *Q.* Would they take *takavi* advances in order to carry them out?—All they could get; more than we can give them for that particular kind of work.

28. *Q.* The tenants or the landlords?—Both. You could put out a lakh of rupees.

29. *Q.* What is the difficulty?—Of late we have been limited in amount. A great deal was given out in the famine.

30. *Q.* Do you spend every pice of it?—Yes.

31. *Q.* Would you like to have more?—Yes.

32. *Q.* Could you find time to dispose of it? Is the establishment sufficient to supervise the distribution of this money?—We have the ordinary establishment. It is quite capable of dealing with a very much larger amount than the present.

33. *Q.* How many years do you allow it to run over?—Three years for a sum of Rs. 50; if larger 5 or 6 years; sometimes 10; not often.

34. *Q.* And you say that the people greedily come for it?—We do not get so many applications as we should if the people knew that the money was to be given.

35. *Q.* (*Mr. Roberts.*)—There is a great deal of difference in the local condition of the people. Have you asked for more money and we have refused?—Yes, I have asked and been refused.

36. *Q.* The particular grant for the year?—It is difficult to gauge our requirements, because the great rush for *takavi* comes at the end of the financial year. I may have spent very little for 11 months and at last get a great rush.

37. *Q.* (*Mr. Muir-Mackenzie.*)—On the other hand, if you ask for a large lump at the beginning of the year; at the end you might find you have no demand?—There is a risk of that at times, but I have not experienced it.

38. *Q.* Why do not you ask for larger sums?—I have to have out my estimates by June.

39. *Q.* (*The President.*)—How much do you spend in a year?—Rs. 15,000. There is a very large amount advanced in the famine, and the arrears were very heavy, and we must get in some of that demand. You cannot keep advancing money to people who are in debt.

40. *Q.* It is 5 years since the famine. A good deal ought to be recovered?—A certain amount has, and a great deal has been remitted, and more will be remitted.

41. *Q.* That is your scheme for better protection?—That with the Ken Canal. It is the only thing where there are no canals.

42. *Q.* I suppose there are good sites for large tanks. Would you advocate that?—Yes, not so much for irrigation as far reservoirs, for drinking water for cattle.

43. *Q.* A very small reservoir goes a long way for that?—There are very few places where you can construct big tanks for irrigation. In places where you can make these big tanks the country is very much broken up.

✓44. *Q.* Are you troubled with *kans?* Do you agree with Mr. Hoare's evidence?—Yes.

45. *Q.* (*Sir Thomas Higham.*)—Have you been consulted at all about the revenue prospects of the Ken Canal?—Not formally, but I have talked it over frequently with Mr. Barlow. I have simply been asked for a general opinion on the subject which I have put on record.

46. *Q.* Do you think there is any possibility of any rice cultivation there?—I think it is quite possible; very reasonably probable.

✓47. *Q.* *In which kind of soil?—In the parwa,* because the canal is not intended to serve *mar* land at all. The project leaves out *mar* altogether.

✓48. *Q.* You think there is no chance for rice except in the *parwa?*—They grow rice in *mar* in other parts of the district.

✓49. *Q.* You think there is no chance for rice except question is whether there will be any rice irrigation either in the black soil or in the *parwa* ?—If they irrigate anything at all, they would irrigate rice rather than anything else.

✓50. *Q.* Is it not a fact that they have never irrigated *anything but rice on the Betwa Canal?—I know* nothing about the Betwa Canal. In the *mar* land they do grow rice in the low-lying places.

51. *Q.* Where do they get water for it?—The embanked fields. They hold up rain water in these parts.

52. *Q.* Is there sufficient rain generally to brigg off a crop of rice?—Inferior rice, yes. The rice grown here is very inferior.

53. *Q.* The people here are of the same class as the people in the Betwa Canal?—I do not know anything about the Betwa Canal. I fancy they must be very much alike. The cultivators are mostly Pathaks and Brahmins.

54. *Q.* The rates for which the Irrigation Department propose to irrigate is one rupee an acre for the water supplied on black cotton soil for a single watering, and Rs. 2-2 per acre for all other irrigation. Have you been consulted at all about those rates? Have you any opinion about them?—The one-rupee rate for *mar* is certainly very fair. For example, I have considerable experience in Government villages with bunds, and when the bund is made out of Government money, the rent is raised to Rs. 2-5 acre in a field where an embankment is constructed.

55. *Q.* Those have been made as relief works?—Either as relief works, or as improvements. We have Government estates there and we make bunds as improvements. Of course I should think a one-rupee rate would be cheap for irrigation.

56. *Q.* (*Mr. Roberts.*)—What is your *bigha?*—$\frac{11}{87}$ of an acre.

57. *Q.* Is that the settlement *bigha?*—Yes.

58. *Q.* (*Sir Thomas Higham.*)—They propose a rate *of one rupee an acre for black cotton soil for a single* watering in October when the monsoons have ceased early, and a second rate, an average rate for all other crops of Rs. 2-2 per acre. Do you think that those rates will be realised?

59. *Q.* It seems very reasonable and it is certainly below the value?—It is cheap.

60. *Q.* Do you think that the acres might be relied on having the distributaries in an ordinary year for 6,000 acres to be irrigated there?—It is absolutely impossible to say what won't happen. So much depends on what the people will do, and it is very difficult to say what the people will do. They may take irrigation or they may not.

61. *Q.* The people are very keen on having something there?—Yes, they like the idea very much.

62. *Q.* There are a large number of tanks made in the Banda district during the famine of 1897; that is to say, bunds thrown across nullas?—Yes.

63. *Q.* Can you say anything about them? What has been the effect of them?—They have done a lot of good, for they have improved the water-supply for cattle drinking; but they are very little used for irrigation.

64. *Q.* Do you think they have improved the well-supply?—They have where wells are close to tanks.

65. *Q.* What distance from the tanks?—A few hundred yards.

66. *Q.* At a greater distance from that the tanks would not be much good?—I do not think so.

67. *Q.* Is there much irrigation from the tanks?—Very little. In the whole district altogether there is not 2,000 acres of it.

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68. *Q*. Then really and truly the main function of these tanks is to draw up water for the use of the villagers and not for irrigation?—Yes.

69. *Q*. If they were used for irrigation, they would become empty very soon?—Yes, they would.

70. *Q*. Do they store water in them? Do you know if they hold water?—A great number hold water; some do not, but they will in time.

71. *Q*. Are they appreciated?—Very much.

72. *Q*. Do they suffer from too much rain in the Bamni district?—Yes, they suffer sometimes. In 1302 they had 84 inches in a year.

73. *Q*. Did that cause rust?—It caused damage by bringing up the *kans*.

74. *Q*. After a dry year do not you get *kans?*—A dry year kills the *kans*. In 1302 we had 80 inches of rain, and that started the *kans;* then there was a year of normal rain, and again in 1304 we had 17 inches of rain only. That caused the famine, but at the same time it killed a very large amount of the *kans*.

75. *Q*. We had evidence at different times about *kans*. I am not quite sure whether it is a dry year or wet year that encourages it?—A wet year.

76. *Q*. It seems to me whenever bund goes out of cultivation that happens?—It is the wet year that causes the land to go out of cultivation. In a year of heavy rainfall it makes the *mar* soil so soft that you cannot plough it. If the rain stops pretty early, it does not do much harm to the *mar*, but then the *kabar* dries up and gets so hard that you cannot plough it either. The *kabar* is a soil that takes up a great deal of moisture and dries very rapidly and very hard.

77. *Q*. (*Mr. Muir-Mackenzie.*)—Might not all these embankments in the fields, in your opinion, be done by famine labour?—A certain amount might.

78. *Q*. It could not be extensively done?—It is very difficult to organise a work of that sort, but a certain amount could be done.

79. *Q*. What would be the effect of the bad organisation? I suppose you would admit a number of people that ought not to receive relief?—You would have one single charge scattered over a large area.

80. *Q*. And there might be some people given relief who ought not to have it?—Yes, that might happen.

81. *Q*. Do not you think it is preferable even with these disadvantages to have some work done which would be very useful to the country rather than have a very perfect organisation of relief and have something of very much less advantage done?—Yes. It would be wasteful of course, but still you would get permanent improvement.

82. *Q*. Do you think the wastage would be very enormous?—It would not be so wasteful as to stand in the way. I have put down some of these in my famine relief programme.

83. *Q*. (*Mr. Rajaratna Mudaliar.*)—Do you consult the tenants before you put down those works as to sites?—Yes, the tenants and zamindars.

84. *Q*. (*Mr. Muir-Mackenzie.*)—Would they raise any difficulties to your making the bunds?—Not the slightest.

85. *Q*. With reference to the advancing of *takavi*, do you think that any advantage would be derived from giving a longer period of repayment?—You would then have the difficulty of security. Joint security is all they can give and it is not a good security for a long advance. The Government loses on it.

86. *Q*. Is it difficult to recover?—Yes.

87. *Q*. Are your outstandings large?—They are fairly considerable, and the reason that they are not very much bigger is because so much has been remitted.

88. *Q*. Was that advanced to tenants or zamindars?—The tenants, I am talking of.

89. *Q*. Do the zamindars pay up?—Yes. We can make them pay up. We have not done it, but we can if we wanted to.

90. *Q*. Is it the case here that the tenants' rent can be enhanced?—Yes, it can be enhanced by law; but it is very unusual and the landlords very rarely take advantage of their powers to enhance tenants' rents.

91. *Q*. Mr. Ferrard says "no exemption is extended to tenants who have extended irrigation to their holdings at their own cost," and he proceeds to specify certain protecting provisions of the law, but I gather they do not help to protect the tenant?—The tenant is quite sufficiently protected down in my parts. He has got the whip hand of the landlord.

92. *Q*. At any rate that is no hindrance to his taking advances?—If a tenant makes an improvement at his own cost, he is always willing to pay extra rent; he does it by agreement with the landlord.

93. *Q*. You are so keen about giving *takavi* advances; what precautions do you take to see that the whole amount reaches a man's hand?—It rests with the tahsildar; the tahsildar is supposed to see that it is paid. A man is supposed to see that it is paid. A man is supposed to go to the tahsil for it.

94. *Q*. Do you think it would be better if the money were given on the spot by Sub-divisional Officers, or perhaps also by tahsildars in the course of their tours?—It could be done.

95. *Q*. Would you think it objectionable to empower tahsildars to grant small advances on their own responsibility?—I do not think so.

96. *Q*. He is allowed to make advances on his own responsibility up to Rs. 250 down south?—If it has worked well down south, I do not see why it should not work here.

97. *Q*. (*Mr. Roberts.*)—Practically speaking, it is not on the recommendations of the tahsildars that the money is advanced?—Yes. Practically the tahsildar is the man who reports whether money ought to be given or not, and he is really the man who fixes the amount to be given.

98. *Q*. (*Mr. Rajaratna Mudaliar.*)—During the famine of 1896-97 I find that a dam was constructed at Ganghuti which is recommended as a useful work for completion?—Yes.

99. *Q*. How much would it cost to build it?—I do not know. It is in the hands of the Public Works Department.

100. *Q*. Would it irrigate any large area at all?—It would not irrigate at all. It is meant as a reservoir for cattle and drinking purposes in a tract where the water-supply is very scarce.

101. *Q*. Mr. Gordon tells me that the *al* root was cultivated as a remedy against *kans?*—As a most paying produce in the days before aniline dyes came in.

102. *Q*. I suppose the aniline dyes have destroyed the cultivation of this crop?—Yes. They have driven it out. The only thing it is used for now is dyeing *kurwa* cloth.

103. *Q*. (*Mr. Roberts.*)—The *takavi* given is for bunds. Has it been given much for bunds since the famine?—I have been giving several thousand rupees a year.

104. *Q*. To tenants or to zamindars?—To both.

105. *Q*. What security do you take from the tenants?—We used to take their trees as security.

106. *Q*. Up to what amount were those trees good enough?—Up to Rs. 40 or Rs. 50.

107. *Q*. Are the bunds you have been giving *takavi* for such as can be executed for that amount?—Small field ones can be executed for that amount.

108. *Q*. In your opinion is there any particular difficulty in making advances on the ground of want of security?—There will be if we give large advances. We cannot take trees as security now.

109. *Q*. Why not?—The Board have forbidden it.

110. *Q*. Since when?—A few months ago.

111. *Q*. On what ground?—That they will be cut down. Suppose a man's trees were sold up, they would be bought by some one else and the outsider would have no use for these trees and would cut them down.

112. *Q*. What other security is there?—Joint responsibility.

113. *Q*. About joint responsibility have you any experience of that?—Yes, very considerable.

114. *Q*. There is more or less difficulty in collection?—Very considerable difficulty.

115. *Q*. That is then another difficulty in the way of extending *takavi?*—Yes, that is the great difficulty.

116 *Q*. A third difficulty in Banda is that the landlords will not stand security for their tenants?—Yes.

117. *Q*. The other case is *takavi* taken by cultivating zamindars mostly in Banda:—Yes, *pattidars*.

118. *Q*. Do they take large advance?—Very considerable.

119. *Q*. They can give security of their shares. That is sufficient for a small embankment?—Quite sufficient.

Mr. H. J. Bell.

3rd Dec. 02.

120. *Q.* Can *takavi* be pushed that way then?—Yes. May I mention one thing more. Mr. Barlow here has a proposal for having these embankments constructed by Government. One point in that, which is of considerable importance, is that bunds, especially large ones, made by zamindars and tenants, often fail, because they do not know how to do them. The great point is that they make no calculations for catchment area. What they do is to see a little slope and make an embankment high enough to correspond with the top of the slope. That is all they look at; they do not consider the area at all.

121. *Q.* What size are these embankments?—Some of the bigger ones are 20 feet; the little ones in the fields may be only a foot high. An acre would be protected by that. Mr. Barlow's idea was that Government should actually carry out the work. I do not know if it is necessary to go so far as that, but I think the making of these embankments should be supervised and the people should be told how to do it.

122. *Q.* (*Mr. Muir-Mackenzie.*)—Of course you have a famine programme?—Yes, a very elaborate one.

123. *Q.* Do you feel quite confident, if famine came on, that these particular works could be at once taken up?—Yes. They are largely digging tanks for drinking supply.

124. *Q.* What percentage of the population would have to be provided for?—I have something like 90 per cent. I have made a very large margin with a view to cutting it down later on.

125. *Q.* What percentage of the population was provided for during the last famine?—Forty-two per cent. was the total number of people relieved in every way.

126. *Q.* That was the highest total at one time of the famine?—That was in the month of May. All May there were 42 per cent. on our works and otherwise relieved. That 42 per cent. was calculated on the population of 1899. It was really about 42 per cent. of the present population.

127. *Q.* Of that how much gratuitous relief?—I do not know. A comparatively small amount.

128. *Q.* Was not it half as much as the labour relief?—I do not remember; I was not in the district then.

129. *Q.* The figures show that there was half as much gratuitous relief as there was Government relief. That would leave you about 30 per cent. to provide for. Do you think you are ever likely to have more relief than that?—It is unlikely, but one cannot say. We know how our calculations were upset in the last famine in other parts of India. The calculations of the former Famine Commission on this point were disproved. I do not think it is safe for anyone to dogmatise in a matter of that sort.

130. *Q.* I see the rice area in Banda in 1895-96 was over 80,000 acres?—Yes.

131. *Q.* Since that it has not got above 40,000?—Yes. We do not attach much importance to rice then, because the quality is inferior.

132. *Q.* Is that broadcast rice then?—Largely broadcast.

133. *Q.* You cannot infer anything from that as to the amount of rice that will be done from the canal?—No.

134. *Q.* What is the principal crop of the district?—*Jowar* and gram. Gram is the biggest area in the whole province and *jowar* too.

135. *Q.* That was the case before the famine too?—Yes. Banda has always been noted for *jowar*, gram, and cotton.

136. *Q.* Will they take water for the cotton?—I do not know.

WITNESS No. 34.—MIR SADIK HUSAIN, of Kalpi, District Jalaun.

Mir Sadik Husain.

3rd Dec. 02.

(*To the President.*)—I own 11 villages, with Government revenue of Rs. 4,000. I irrigate my land from the Betwa Canal in *rabi only*. Rice cannot be irrigated from the canal. The Hamirpur Branch is not open in *kharif*. Rice is generally sown before rains.

(*Mr. Atkinson.*)—(During the last three years there was no freshet or rain till July; therefore we cannot make early sowings of rice. People want water, but very little water is available at tails of distributaries even now. *Kans* is due to fields thrown out of cultivation. Cultivators do not get *takavi* at most convenient time. They get money from the mahajan whenever they want it. Digging 4 or 5 feet deep kills *kans*. I have never seen bunds made to kill *kans*; 30 or 35 per cent. of the cattle died; the remainder was saved by being sent away. I sowed rice once before famine; I did not get water from the canal. Many others tried it. It was water rice. I never tried autumn rice, but will try it now.)

WITNESS No. 35.—DEWAN UDIT SINGH, Raksha, District Jhansi.

Dewan Udit Singh.

3rd Dec. 02.

(*To the President.*)—Raksha bund was made in the famine of 1877. Twenty-nine tanks were made by Government. All the good the tanks did was to keep up a good supply in the wells. It will be a good thing to make the lower bund *pakka* and take out a canal.

WITNESS No. 36.—THAKUR BHAGWAN DAS, Lambardar, Barwa Sagar, District Jhansi.

Thakur Bhagwan Das.

3rd Dec. 02.

(*To the President.*)—Barwa Sagar irrigates 3 or 4 villages; in my village it irrigates 400 or 500 *bighas*. Wells are 18 or 20 feet. There are many wells, but not inside the tank commanded area. The zamindars and tenants make wells; they do not usually take *takavi*; one or two did take it, but do not take any now, as there is no need for it.

TWENTY-FIRST DAY.

Jhansi, 4th December 1902.

WITNESS No. 37.—MR. N. F. MACLEOD, Executive Engineer, Upper Division, Eastern Jumna Canal.

Mr. N. F. Macleod.

4th Dec. 02.

1. *Q.* (*The President.*)—You are Superintending Engineer of the 1st Circle?—Not now. I was in the hot weather, but I am now Executive Engineer of the Upper Division, Eastern Jumna Canal, at Saharanpur.

2. *Q.* How long did you hold the 1st Circle?—Three months last hot weather.

3. *Q.* Have you been long in the Eastern Jumna?—I have been there nearly three months. I was on leave before that. I left Fatehpore in 1900 and was at home all last year.

4. *Q.* Then your experience is chiefly of the Lower Doab?—Yes, and my Division now, the Eastern Jumna.

Mr. N. F. Macleod.

4th Dec. 02.

5. *Q.* Has the same economising of water been going on in the Eastern Jumna as elsewhere?—Yes, the same system.

6. *Q.* Have they reduced the size of the old *colaba?*—Yes.

7. *Q.* What size is it now? It used to be 10 by 8?—The double eight one is the biggest anywhere now.

8. *Q.* Have you taken out a great number of *colabas?*—Yes.

9. *Q.* Was there any formal protest against that?—Of course there was a formal protest against that.

10. *Q.* The reason I asked you that was because when I was Executive Engineer of the Eastern Jumna Canal, the zamindars had a proprietary right to the *colabas* and paid for them. That has been wiped out entirely?—Yes, that has altogether gone.

11. *Q.* On the Eastern Jumna have you been able to effect large economies by these measures?—Yes, very great economies.

12. *Q.* What do you do with the water economised?—It is utilised elsewhere.

13. *Q.* But where, in extension lines?—Partly in extension lines, and in the fact the villages which did not get water before on the outlying land are now getting it.

14. *Q.* Are you giving more water to the villages that did get water before?—No.

15. I suppose there is a very large proportion of irrigation in many of your villages?—In some villages it is very large, but that is always at the head of the *guls*: the tail does not get anything.

16. *Q.* Are you fixing any standard beyond which the proportion of irrigated land in the village ought not to go?—Not in old established irrigation.

17. *Q.* And in reducing the size of outlets you are not deliberately trying to reduce the area of irrigation in any particular place?—No.

18. *Q.* For instance about Bantowa and places like that?—Where it is rice irrigation you cannot. You feel that you ought to have the principal irrigation in the land. It is their summer crop.

19. *Q.* The *kharif* crop?—Yes.

20. *Q.* Is the *kharif* up to the *rabi* now in the Eastern Jumna?—It is bigger than the *rabi*. It varies a little bit. It is generally bigger.

21. *Q.* I suppose there is no original work of any magnitude going on?—None. They are all extensions of systems, reductions of old water-courses and putting in minors. That is the principal work.

22. *Q.* Is there extension of drainage or is that finished?—It is pretty well finished there.

23. *Q.* Do you happen to know from past information or from records whether very distinct benefit has been done in reducing *reh* by the drainage?—There is so little *reh* in the upper part of the Jumna to effect at all. There is no pure *reh* there. You have that *kala* land there as you call it. That is not as you understand *reh* down in these parts.

24. *Q.* Is that *kala* land helped by the drainage at all?—Yes, it is.

25. *Q.* Do you know of any instances in which land has been brought back to cultivation?—I am afraid I cannot give you any instances.

(*Mr. Marsh.*)—We have done some of that in Etawah.

26. *Q.* (*The President.*)—What officers have you under in the Eastern Jumna?—Three Sub-divisional Officers, one Upper Subordinate (European) and another native Upper Subordinate.

27. *Q.* You have no Assistant Engineers?—No.

28. *Q.* If you go on leave, one of the Upper Subordinates comes in charge of the Division?—Yes, unless other arrangements were made.

29. *Q.* Are the relations with the Revenue Officers all satisfactory?—Yes. They have accepted all our proposals absolutely and seen the benefit now of them.

30. *Q.* In matters of measurement and assessment does all that work satisfactorily?—Yes, that works very smoothly with them.

31. *Q.* Is there a permanent dam over the Jumna now?—No. We are still working at Kara with a temporary bund.

32. *Q.* You were before at Fatehpore?—Yes.

33. *Q.* That is construction work purely?—Yes.

34. *Q.* Do you get anything worth mentioning in the return from water-power?—They have not done much in using water-power there at all. The old mills run everywhere; there is no big town to create a demand. The mills pay very well in the Eastern Jumna Canal.

35. *Q.* Has nobody taken up the water-power?—There is a scheme now on; they want to harness the Jumna.

36. *Q.* (*Sir Thomas Higham.*)—How do you arrange the distribution of the supply?—The Eastern Jumna Canal takes one-third and the Western Jumna Canal two-thirds.

37. *Q.* Between you how do you determine that?—It is determined by the Kalsia and Dadupur gauge.

38. *Q.* They used to have in any time?—

39. *Q.* Then supposing the equal gauge gives one side more or less than its share?—That works in all right in the whole year. We are just as keen after getting our fair allotment as they are after getting theirs.

40. *Q.* Do the gauges give that fair allotment?—Yes.

41. *Q.* These gauges were established a great many years ago?—We have started a new table for the Dadupur rapid.

42. *Q.* It is not equal gauges?—No.

43. *Q.* When I was there many years ago it was equal gauges?—It is 5·1 in Kalsia and about 2·4 at Dadupur.

44. *Q.* You have discharge tables?—Yes.

45. *Q.* Do you close very often in the cold weather?—Not often. If you get good rains after Christmas, you close in February.

46. *Q.* Do not you generally close once in January?—If there is rain. It is very rare.

47. *Q.* Have you got all the projects in for improvements here that are necessary?—Most of them. There is a very small minor yet to come in.

48. *Q.* What share of the supply do you take for your division?—About one-third.

49. *Q.* And two-thirds go to the Lower Division?—Yes. They get two weeks water to my one week.

50. *Q.* You pass water down in the Nowshera escape?—Never in the supply season. That is only a flood escape.

51. *Q.* If you did not utilise the whole of your one-third share of the supply, you could still take it from the river and pass it down the Nowshera escape for the Agra canal. You never do that?—No.

52. *Q.* You let the Western Jumna have it?—Yes.

53. *Q.* Whatever you take during the *rabi* out of the river you utilise on the canal?—Yes.

54. *Q.* You never take out more than you want?—No.

55. *Q.* In the Agra Canal I suppose you depend mainly on the supply you get from the Ganges?—Yes, through the Hindon.

56. *Q.* From Jani?—Yes.

57. *Q.* How much do you get?—Up to a thousand cusecs.

58. *Q.* Do you get a thousand?—500 or 600 cusecs.

(*Mr. Marsh.*)—It is not allowed to fall below one thousand cusecs.

WITNESS No. 38.—MR. A. C. H. LAURIE, Executive Engineer, Betwa Canal.

Note on possible extension of irrigation into Minor Doábs.

Mr. A. C. H. Laurie.

4th Dec. 02.

The accompanying 1" to mile map shows all existing channels of Betwa Canal system in thick blue lines, drainage lines in full black, and those channels for which projects have from time to time been mooted in dotted red lines. It will be seen that there is hardly a patch of country, barring Native State lands, of any considerable extent which has not been investigated with a view to its irrigation.

The two principal areas into which irrigation has so far not penetrated are (1) the tract along the right bank of the Jumna in pargana Kalpi, and (2) the stretch of country between Ait and Orai in pargana Orai. Both of these are indicated by a sepia wash in the 1″=1 mile tracing of the Betwa Canal. Dealing first with these two areas:—

Extension of irrigation.—As regards the tract in pargana Kalpi, so far as I am aware, no project for its irrigation has ever been drawn up. I am not well acquainted with it personally, but from enquiries it appears to consist largely of good irrigable *parwa* soil, in places much cut up by ravines. The only possible means of extending irrigation to it would evidently be from the tail of Tarsaur distributary. A cursory investigation of the possibility of this was made last year by Babu Abdus Sattar, Sub-Engineer, and it was reported on unfavourably by him, the country in the line of advance being full of intricate ravines. A thorough investigation might find a way over this difficulty, a small aqueduct or two probably only being required.

The tract in pargana Orai has been thoroughly investigated, and detailed estimates prepared for two channels called the Ait and Garhar distributaries, which would bring water to its entire area. These projects have never been carried out, not on account of any engineering difficulties, but for the reason that the soil is almost entirely pure, unalloyed *mar.*

Irrigation in *mar* soil is beginning to show signs of development in the lower parts of the Hamirpur branch.

From my own observations of the effect of irrigation in *mar* soil during my camping last cold season, I have no doubt that canal water doubles and trebles the output in dry season, such as have been experienced since 1896-97.

The cultivators have a rooted prejudice against irrigating *mar* which time and experience will alone wear down. The Orai distributary, which traverses exactly similar country, has so far shown very poor results, and until *mar* irrigation is established on this channel, it would be useless making the Ait and Garhar distributaries. With regard to the smaller minor projects possible, I cannot speak from personal knowledge. A list of all minor projects hitherto considered, but not yet carried into execution, is given below.

Native State minors are marked with an asterisk and will not be dealt with, as their construction depends upon the wish of the State. Referring to numbers in list—

(1) *Moth minor* will be a useful project; the percentage of *mar* soil is not too excessive.

(3) Water was greedily taken in famine of 1896-97, the cultivators digging a long *gul.*

(5) and (6) Can give no opinion for or against. Soil chiefly *mar.*

(8) and (9) Can give no opinion. Soil largely *mar.*

(10), (11), (12), (13), and (14) Would be useful minors, I think, as soil is mixed with *parwa.*

(16) and (17) Soil entirely black cotton, and, judging from results up to date on Jalaun distributary, their construction may with advantage be deferred.

(18) and (19) Separately treated of.

(20) and (21) Would be useful minors; irrigation in these parts is sought after by cultivators.

(24) Can give no opinion.

As a general rule, excepting in the vicinity of the larger drainages, the country is admirably adapted to the construction of canal channels, having ample longitudinal and lateral slopes and for the most part as flat as a table. The question is simply one of soil.

Main Canal.

(1) Moth minor, taking out in mile 16, right bank.
*(2) Lamai „ „ 20, left „

Kathaund Branch.

(3) Belma minor, taking out in mile 1, right bank.
*(4) Samthar „ „ 3, left „
(5) Barhal „ „ 17, „ „
(6) Kunch „ „ 18, right „
*(7) Sami „ „ 21, „ „
(8) Kakrauli „ „ 23, left „
(9) Kudari „ „ 23, right „

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(10) Rámpur minor, taking out in mile 47, left bank.
(11) Jajipura „ „ 47, right „
(12) Jagamanpur „ „ 51, left „
(13) Bastipur „ „ 15, right „ Tarsaur distributary.
(14) Salimpur „ „ 1, right bank, Daulatpur distributary.

Hamirpur Branch.

*(15) Amgaon distributary, taking out in mile 4, left bank, Hamirpur branch.
(16) Gargawan minor, taking out in mile 30, left bank, Jalaun distributary.
(17) Kusmara minor, taking out in mile 31, right bank, Jalaun distributary.
(18) Ait distributary, taking out in mile 21, left bank, Hamirpur branch.
(19) Garhar distributary, taking out in mile 25, left bank, Hamirpur branch.
(20) Kharka minor, taking out in mile 46, right bank, Hamirpur branch.
(21) Parasan minor, taking out in mile 55, right bank, Hamirpur branch.
*(22) Karamchandpur, taking out in mile 56, right bank, Hamirpur branch.
*(23) Harchandpur minor, taking out in mile 3, right bank, Parausa minor.
(24) Shekhpur, taking out in mile 11, right bank, Seoni distributary.

Notes on Storage Works, Betwa Canal Division.

(1) Area and nature of catchment.

Paricha Reservoir.—The Paricha Reservoir obtains its supply from the river Betwa, which is dammed up by a masonry weir about 1 mile in length from end to end and of an average height of 20 to 25 feet above river bed. The Betwa river rises in the northern slopes of the Vindhyan range of Central India near the town of Bhopal, and follows a more or less north-east course. The nature of the country in its upper reaches is of sandstone hills, and this formation continues until it reaches a place called Jakhlaun on the borders of Lalitpur district, where it debouches upon an undulating country of low ranges of hills consisting for the most part of trap rocks, and this formation continues right up to Paricha about a hundred miles below. I cannot speak of the nature of the soil in Central India, but in the district of Lalitpur it consists for the most part of red sandy soil much mixed with boulders and pebbles, and in parts of black cotton soil. There are numerous small tributaries running into it on both banks, the only two of any size above Paricha being the Jamini and Bina rivers, both of which are on its right bank. The total catchment area above Paricha is about 10,000 square miles. Due to the non-absorbent character of much of its catchment and its rapid slopes, the Betwa is liable to sudden and heavy floods.

(2) Average annual rainfall.

The average annual rainfall over its catchment varies from 30″ to 35″ in Central India to 30″ to 40″ in Lalitpur and Jhansi. The latter is liable to large diminution in years of drought, but the former is more constant. Whereas the rainfall of 1868† was only 14″ in Jhansi, it was 32″ in Central India.

† Famine year.

(3) Full supply capacity.

The full supply capacity of Paricha Reservoir is 2,750 millions of cubic feet; this includes the additional supply stored by means of the shutters recently added.

(4) Percentage of capacity on run off due to total average rainfall.

The meaning of this question is not understood quite clearly. I will answer it as best I can. The percentage of run off in country similar to the Betwa catchment may be put down as between 60 and 70 per cent. Taking average rainfall as, say, 35″, then run off will be $\frac{65}{100} \times 35'' = 23''$ nearly; volume run off will be 10,000 square miles by 23″

$$=10{,}000 \times 27{,}878{,}400 \text{ square feet (say 2 feet)} \times \frac{23}{24}$$

$$=557{,}560{,}000{,}000 \text{ cubic feet.}$$

$$\text{Per cent. storage to run off} = \frac{2{,}750{,}000{,}000 \times 100}{557{,}568{,}000{,}000} = 0{\cdot}5 \text{ p.c.}$$

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* Native State minors.

Mr. A. C. H. Laurie.

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Table of discharge of the Betwa river.

Year.	Month.	Date.	Discharge.
1867	December	21st	1,028
1868	January	18th	878
	February	5th	740
	Ditto	17th	590
	Ditto	29th	427
	March	6th	343
	Ditto	18th	250
	Ditto	30th	220
	April	5th	196
	Ditto	17th	145
	Ditto	29th	109
	May	6th	100
	Ditto	18th	89
	Ditto	30th	74
	June	6th	70
	Ditto	19th	68
	Ditto	30th	68
	July	6th	120
	Ditto	18th	914
	August	22nd	4,072
	September	30th	1,500
	October	30th	160
	November	30th	81
	December	30th	71
1869	January	30th	62
	February	30th	53
	March	30th	44
	April	30th	15
	May	30th	...
	June	30th	...
	July	30th	22,000
	August	30th	...
	September	30th	45,000
	October	30th	...

This table is taken from sections from the records of Government of India, Public Works Department, No. CCXXXII Public Works Department, serial No. 12, Betwa Canal Project.

The chances against the reservoir filling are therefore very remote. A table of observed discharges of Betwa river from December 1867 to October 1869, a period which includes a season of severe drought, is given above. From a perusal of it any remaining doubts will be dispelled.

A few recent observations are given below comprising the period of drought just experienced:—

Year.	Month.	Date.	Discharge.
1896	October	15th	648 cusecs.
1896	December	4th	260 do.
1897	January	10th	165 do.
1897	March	25th	9 do.
1897	November	29th	449 do.
1897	December	30th	258 do.
1898	January	10th	300 do.
1898	Ditto	27th	305 do.
1898	February	28th	195 do.
1898	March	29th	33 do.
1899	October	27th	64 do.
1899	December	12th	4 do.
1900	October	11th	788 do.
1900	November	24th	674 do.
1900	December	11th	603 do.
1901	January	17th	434 do.
1901	February	13th	177 do.
1901	March	14th	172 do.
1901	October	1st	2,757 do.
1901	December	9th	204 do.

(5) Water-spread at full supply.

(6) Capital cost.

(7) Scale of water rates.

The waterspread at full supply is about 4 square miles the length being 16 miles and average width about ¼ mile.

The total capital cost will be found from accompanying memorandum, Appendix I up to 1900-01.

See Appendix II.

II.—Annual statistics for typical years.

It will be best to treat this in narrative form, as many of the heads, such as (3) amount run off, (4) and (5) are quite impossible to define.

There are two typical cases which will require dealing with separately and both of which have been experienced during the recent cycle of dry years. They are:—

I.—Drought accompanied with a large surplus volume of water passing down river which is available for irrigation without the necessity of drawing on our reservoir supply. Such conditions occurred in 1896, the first year of drought cycle.

II.—Drought with a low volume in river, when the river supply is less than canal discharge and reservoir storage is called upon to make up the deficiency. This was the state of affairs in 1899 when rains ceased early and canal had to be opened to save standing *kharif* and paleoing for *rabi* sowings.

Table of rainfall for both these years will be found below.

Table of Rainfall for the years 1896 and 1899.

Station.	Rainfall.												
	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Total.
1896-97.													
Paricha	...	...	7·20	16·7	6·3	...	...	0·5	...	1·8	...	...	32·50
Orai	...	...	4·5	4·4	12·7	...	...	0·2	0·9	2·0	...	...	24·07
Bungra	...	...	4·8	8·3	5·1	...	...	0·4	0·2	2·0	...	...	20·80
1899-1900.													
Paricha	0·2	0·3	16·2	11·1	0·9	1.5	...	...	...	0·2	...	...	30·3
Orai	0·4	0·3	10·4	11·3	8·3	2·0	...	...	...	0·2	...	...	32·9
Bungra	...	0·4	4·2	10·5	3·1	2·3	...	...	...	0·5	...	...	21·0

Dealing with the former contingency as experienced in 1896.

The rains practically ceased in the 3rd week of August, and by the middle of September demand for *kharif* became strong and the distributaries were all opened for irrigation. A supply of 800 cusecs was run in canal during the remainder of September, increased to 900 during first-half of October and 1,000 cusecs for the latter half of same month, when *rabi* paleo began to assert itself. The canal remained open till the 10th November, but with a reduced supply. It will be seen from reference to the table of observed discharges that as late as October 15th the discharge in river was as high as 643 cusecs, being naturally much greater in September.

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The reservoir was still brimful at the beginning of October in spite of heavy draw of canal.

With a failing supply in river and canal still running 1,000 cusecs the reservoir began to fall soon after 1st October, and had fallen 18" below crest by 15th and 8½ feet below by end of the month.

When canal was closed on 11th November the reservoir supply stood at 12 feet below crest of weir, which had thus been depleted of about 1,300,000,000 cubic feet, or three-fourths its total storage. The crisis was over, and in spite of canal running, though intermittently and with a less supply, the reservoir gradually recovered, and towards end of February had gained 5 feet, being 7 feet below weir crest. After satisfying all *rabi* requirements the reservoir stood at 615·75 at end of March.

The result was that 25,000 acres of late *kharif* were irrigated in September and October without touching reservoir storage, and in addition a record *rabi* of over 60,000 acres was secured, besides leaving sufficient water in reservoir for following *kharif* sowings.

The season of 1899 was an example of drought accompanied by a low river. The rainfall was continuous and copious during the whole of July and a few showers at the beginning of August were received; a break then set in which continued till the end of the month excepting a few showers about 15th. A good fall was received about the end of August and was again followed by a break up to 15th September, when about 2 to 2½ inches rain fell; after this there was no further rainfall. But for the rainfall of 15th September demand for standing *kharif* would have been general as in 1896; but instead of the river-supply being able to meet demand for canal as in former year, it would have been quite inadequate and a draw would immediately have commenced on the reservoir, which by the time *rabi* paleo set in, which was about 2nd week of October, would have become considerably exhausted. When paleo for *rabi* began about middle of October the river discharge could not have been more than 100 cusecs, whereas canal demand was 225 cusecs, rising to 350, for the last week of the month. Canal demand continued strong for paleo till beginning of December, and with a failing supply in river: the consequence was there was a gradual diminution of reservoir supply, and by 5th December the supply stood at 279 millions cubic feet against a total storage supply of 1,698 millions cubic feet. Under the conditions water had to be conserved most carefully, but for which larger supplies could have been run and a much larger *rabi* area secured. As it was only 33,000 acres was done, and of this some 650 acres was destroyed for want of subsequent waterings. There is no reason why as large an area should not have been irrigated as in 1896, *viz.*, 60,000 acres.

The water-supply barely sufficed to see the *rabi* through small as was the area irrigated, and there was nothing left for following *kharif*.

Bundelkhand Irrigation Lakes.

The information available with regard to these works is most meagre, and no definite replies can be given to the questions put.

These lakes, of which there are 4 in Jhansi district, *viz.*, Barwa Sagar, Pachwara, Magarwara and Kachneo, and 8 in Hamirpur, *viz.*, Kalian Sagar, Kerat Sagar, Madan Sagar, Bijanagar, Dasrapur, Thana, Tikamau and Bela Tal, were originally constructed by the Chandel Rajas of Bundelkhand, and subsequently remodelled and repaired by the British Government. No surveys or plans showing catchment, etc., exist if they ever have been made. The tanks were originally under the District Authorities and passed through the Roads and Buildings Branch into the hands of the Canal Department in 1890.

They are situated at a considerable distance apart and away from the Betwa Canals, and but little attention has been able to be bestowed on them, which condition of affairs must continue so long as they are not constituted into a special sub-division. With the exception of Barwa Sagar and Bela Tal, which are fed from considerable streams and have large storage capacities, the lakes may be said to suffer from lack of water in years of drought.

The table opposite shows full supply gauges and volumes with the maximum depths and volumes to which water has been stored in each year since 1896. The unsatisfactory nature of the sources of supply in most of them will be seen at a glance:—

Name of tank.	Full supply.		Maximum.													
			1896.		1897.		1898.		1899.		1900.		1901.		15th September 1902.	
	Gauge.	* Volume.	Gauge.	* Volume.	Gauge.	* Volume.	Gauge.	* Volume.	Gauge.	* Volume.	Gauge.	* Volume.	Gauge.	* Volume.	Gauge.	* Volume.
Barwa Sagar	13·0	324½	13·0	324½	13·0	324½	13·0	324½	13·0	324½	13·0	324½	13·0	324½	13·0	324½
Pachwara	26·0	308	21·03	255	19·2	153	21·48	198	21·50	267	23·70	247	26·0	308	24·10	257
Magarwara	21·30	59	17·2	29	11·8	9	1·76	...	13·42	13	16·50	25	16·2	23	16·0	22½
Kachneo	16·17	160	9·28	59½	4·20	17	2·95	10	12·46	100	10·97	79	10·6	74	10·15	68½
Kirat Sagar	9·02	66¼	5·78	36¾	8·0	56	8·40	60	7·28	49½	4·06	28¾	5·50	34	2·20	11
Madan Sagar	8·18	88¼	3·00	22	5·20	45	8·13	88¼	7·60	69	3·95	30¼	4·20	57½	0·50	3
Kalian Sagar	8·73	17¾	6·99	10¾	8·73	17¾	8·73	17¾	8·45	16	4·55	4¾	8·73	17¾	4·20	4
Bijanagar	12·45	189½	6·93	81	7·6	93	12·25	180½	11·6	174½	5·05	53	7·30	88	...	...
Thana	15·46	112½	12·20	64¼	13·41	81½	14·5	93¾	13·40	81½	10·0	42	11·93	62	5·60	13
Dasrapur	11·0	119½	7·00	54	8·0	68	10·40	108¼	8·40	74½	8·70	79	9·60	92½	5·70	39
Ticcamau	10·0	18¾	9·2	11¼	6·25	6	9·25	11¾	7·40	8	5·90	5½	8·78	10¾	2·70	1¼
Bela Tal	7·50	353	7·50	353	7·50	353	7·50	353		353	7·50	353	7·50	353	7·0	353

* Volumes in millions cubic feet.

Initial statistics.

Dealing with questions *seriatim*.

(1) Not known in any case.

(2) About same as for Jhansi, about 35".

(3) See table above.

(4) Not answerable as catchment unknown.

(5) See table below:—

Table of waterspread of tanks.

Name.	Area in square feet at full supply.	
Barwa Sagar	43,116,250	square feet.
Pachwara	29,962,400	ditto.
Magarwara	8,895,000	ditto.
Kachneo	18,752,000	ditto.
Karat Sagar	10,596,000	ditto.
Madan Sagar	14,997,000	ditto.
Kalian Sagar	4,562,000	ditto.
Bijanagar	42,450,000	ditto.
Thana	19,716,000	ditto.
Dasrapur	18,701,000	ditto.
Ticcamau	2,675,000	ditto.
Bela Tal	70,370,000	ditto.

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(6) Not known as tanks were not constructed by Government.

(7) See Appendix III.

Annual statistics.

(1) See table below :—

Statement showing rainfall.

Station.	Rainfall.												
	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Total.
1896-97.													
Barwa Sagar	...	...	6·25	11·53	5·31	0·05	...	0·37	0·40	1·93	...	...	25·84
Pachwara	...	...	5·84	15·22	10·42	0·20	...	1·47	0·58	1·60	...	...	35·33
Magarwara	...	...	1·79	6·42	3·12	0·02	...	0·85	0·05	0·85	...	...	13·10
Bela Tal	...	...	3·60	13·95	6·70	0·10	...	...	0·70	1·50	...	...	26·55
Bijanagar	...	...	5·83	13·37	9·29	0·48	...	0·35	0·63	2·35	...	...	32·30
Thana	...	...	5·87	16·26	9·89	0·94	...	0·60	0·40	1·95	...	...	35·91
1899-1900.													
Barwa Sagar	0·70	...	16·16	12·54	0·60	0·18	...	...	...	2·58	...	...	32·76
Pachwara	0·20	...	11·25	7·50	2·05	2·35	...	...	...	1·60	...	...	24·95
Magarwara	...	...	8·10	10·98	1·58	0·68	...	...	...	0·35	...	...	21·69
Bela Tal	0·42	...	16·60	9·58	7·56	1·40	...	...	...	0·99	...	...	36·55
Bijanagar	0·55	0·35	10·61	17·35	6·83	3·90	...	...	...	0·97	...	...	40·56
Thana	0·50	0·50	12·99	15·73	5·83	3·60	...	...	...	0·94	...	...	40·09

(2) See table, Appendix IV.

(3) Not measurable.

(4) Ditto.

(5) Ditto.

(6) See Appendix V.

(7) Ditto VI.

APPENDIX I.

Statement showing Capital Outlay on Betwa Canal to end of 1900-1901.

Heads of Account.	Amount.	Remarks.
Works.	Rs.	
(1) Head Works	11,01,125	
(2) Main Canal and Branches	16,99,958	
(3) Distributaries	4,48,123	
(4) Drainage Works	...	
Total	32,49,206	
II Establishment	9,06,179	
III Tools and plant	97,918	
IV Suspense	23,501	
Loss by exchange	207	
V Less receipts on Capital Account	8,617	
Total, Direct charges	42,68,294	
Indirect charges	2,23,633	
GRAND TOTAL	44,91,927	

APPENDIX II.

SCHEDULE OF RATES IN FORCE.

I.—*Occupier's Rates.*

Betwa Canal.

Class.	Name of crop.	Per acre irrigated.		Per
		Flow.	Lift.	
		Rs. a. p.	Rs. a. p.	
I	Sugarcane	6 10 8	3 5 4	Year.
II	Tobacco, poppy and spices, vegetables, gardens, orchards, waternuts; also indigo, rice and other *kharif* crops for which water is taken before 15th June.	4 0 0	2 0 0	Crop.
III	All *rabi* crops, except unmixed grain; also cotton and indigo for which water is taken after 15th June.	3 0 0	1 8 0	Do.
IV	Unmixed gram; also rice for which water is taken after 15th June, and all *kharif* crops not specified above.	2 0 0	1 0 0	Do.
V	"Paleo," for *rabi* not again irrigated.	1 0 0	0 8 0	Do.
	(*Vide* Notification No. 8441, dated 10th March 1897.)			

On fields of which the soils are classed as *mar* or *kabar* in the settlement records the rates for the *rabi* crops specified under classes III and IV and for class V (Paleo) shall be half the respective rates fixed for these classes in the above schedule

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APPENDIX III.

SCHEDULE OF RATES IN FORCE.

Occupier's Rates.

Jhansi and Hamirpur Lakes.

Class.	Name of crop.	Per acre irrigated. Flow.	Per acre irrigated. Lift.	Per
I	Sugarcane . . .	3 5 6	1 10 9	Year.
II	Rice, tobacco, opium, vegetables, gardens and waternuts.	2 4 0	1 2 0	Crop.
III	All *rabi* crops . .	1 11 0	0 13 6	Do.
IV	All *kharif* crops not specified above. (*Vide* Notification No. 012501-C., dated 28th May 1873, and No. C.-40-W., dated 22nd April 1878.)	1 2 0	0 9 0	Do.

(7) Irrigation from tanks filled from the Betwa Canal for domestic, village, municipal or railway purposes is charged the full lift rate of crop. (*Vide* Irrigation Branch Notification No. C.-6871, dated 6th September 1886.)

APPENDIX IV.

Amount of water stored during the year.

Lakes.	Amount of water in million cubic feet stored. 1896-97.	Amount of water in million cubic feet stored. 1899-00.
Barwa Sagar . . .	324½	324½
Pachwara	255	267
Magarwaras . . .	29	13
Kachneo	59½	100
Kirat Sagar . . .	36½	49½
Madan Sagar . . .	22	69
Kalian Sagar . . .	10¾	16
Bijanagar . . .	81	174½
Thana	64½	81½
Dasrapur	54	74½
Ticcamau	11¾	8
Bela Tal	353	353
Total .	1,301½	1,530¼

APPENDIX V.

Statement showing area irrigated in acres.

Lakes.	Area irrigated. 1896-97. Kharif.	Rabi.	Total.	1899-1900. Kharif.	Rabi.	Total.
Barwa Sagar .	104	300	404	121	421	542
Pachwara .	90	531	621	66	867	933
Magarwara .	...	150	150	...	15	15
Kachneo . .	...	48	48	...	168	168
Kirat Sagar .	.	17	26	1	2	3
Madan Sagar .	133	198	331	42	269	311
Kalian Sagar .	40	66	106	2	105	107
Bijanagar .	159	437	596	44	556	600
Thana . .	103	294	397	20	317	337
Dasrapur .	31	62	93	5	88	93
Ticcamau .	41	...	41	...	41	41
Bela Tal .	438	663	1,101	41	642	683
Total .	1,148	2,766	3,914	342	3,491	3,833

APPENDIX VI.

Statement showing quantity of water left in tank at end of irrigating season and available for next year.

Lakes.	Quantity of water in million cubic feet left in tank. 1896-97.	Quantity of water in million cubic feet left in tank. 1899-00.
Barwa Sagar . . .	94¾	160¾
Pachwara	95½	139½
Magarwara	...	5¾
Kachneo	14½	31
Kirat Sagar . . .	8½	18½
Madan Sagar . . .	...	8½
Kalian Sagar . . .	...	...
Bijanagar . . .	4	55¾
Thana	11½	31¼
Dasrapur	...	...
Ticcamau	...	...
Bela Tal	129¼	158
Total .	358	609

1. *Q.* (*The President.*)—How long have you been in the Betwa Canal?—I joined the Betwa Canal at the end of April last year, so that I have been there about a year and eight months.

2. *Q.* Where were you before?—I came here from the Etawah Division: I had been there six months.

3. *Q.* What is your feeling about the irrigation of *mar* soil?—You know they have a rooted prejudice against the irrigation of *mar* soil; in that they have been able to grow crops without irrigation. I think in years of scanty rainfall that artificial irrigation from canals or any other source is certainly a great advantage.

4. *Q.* Do you think in average years that it is a positive disadvantage, or merely that it is not wanted?—There would be very little to choose between the two.

5. *Q.* Have you had any consultation with the Agricultural Department about it?—No.

6. *Q.* Do you know how deep the *mar* is in this country?—It varies in places, from a few feet to ten or 15 feet or more.

7. *Q.* Do you know what underlies it?—I have never dug down to the foundation; I think, as a rule, it is *kunkrie* soil; what they call *rankar* here.

8. *Q.* Supposing the *mar* was left out altogether and that you were to irrigate the country commanded by the Betwa Canal, about how much land is there to irrigate? Is the *mar* about 30 per cent. of the whole thing?—Not so much as 30 per cent. I can give you the figures exactly: they were taken out under the instructions of Mr. Palmer, who was Chief Engineer last year. In the Kathaund Branch, which is the one that runs through most of the *purwa* soil, in dry years, including *mar*, 70,909 acres would have to be irrigated, and omitting *mar* soil 55,000 acres. These areas are based on 50 per cent. of the normal cultivated *rabi* area being irrigated.

9. *Q.* Commanded?—Actually to be irrigated.

10. *Q.* Of that how much is *mar*?—The cultivated *mar* area is practically 30,000 acres. In the case of the other branch, the Hamirpur Branch, including *mar* soil, we have to irrigate 122,000 acres, and omitting *mar* soil, 61,000 acres. That is a difference of 50 per cent. The cultivated area of *mar* soil is therefore 122,000 acres.

11. *Q.* Have you any more branches, or is that the whole of the Betwa Canal?—That is the whole of the Betwa Canal.

12. *Q.* Rejecting *mar* altogether you would like to irrigate up to 116,000 acres of *rabi*?—Yes. Half the normal cultivated *rabi* area of the total area commanded by the Betwa Canal is 189,000 acres, of which 64,000 acres

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is *mar* and 12,735 is irrigated from all sources, excepting canals.

13. *Q.* Does that mean much tank irrigation or chiefly from wells?—Chiefly from wells.

14. *Q.* That is just about 30 per cent.—Yes. Of course the *mar* soil being rich is more sought after by cultivators, but the actual superficial *mar* soil in the district is not so much as 30 per cent.

15. *Q.* To irrigate this 116,000 acres, which is exclusive of *mar*, you ought to have 600 cubic feet a second?—We base our discharges on the factor of 100 acres per cusec.

16. *Q.* Then you want 1,200 cusecs?—Yes, about.

17. *Q.* What is your registered discharge in the *rabi*?—We could not run 1,200 cusecs at present in the branches because we could not carry it.

18. *Q.* What is your maximum discharge in the Betwa Canal itself?—We could run up to about 1,200 cusecs in the main canal; we could not carry that in the branches.

19. *Q.* What do you run?—We cannot take off more than 800 or 900 cusecs between the two branches.

(*Mr. Marsh.*)—It is worked by a reservoir.

20. *Q.* (*The President.*)—Could you count on having at your disposal 800 or 900 cubic feet per second during the *rabi*?—I do not think so; not river supply.

21. *Q.* How much could you count upon?—500 for the *rabi* at most.

22. *Q.* What is the capacity of your reservoir?—The present capacity of the reservoir with the shutters is about 2,750 million cubic feet.

23. *Q.* If you run it off at the rate of 350 cubic feet per second, you will get rid of the supply in your reservoir before you are likely to get any more into your reservoir?—This year it is decreasing very slowly indeed judging from the gauges. I should think this discharge will gradually decrease by Christmas-time; I do not think it will go down more than 150 cusecs; we should have about 350 coming down the river, and I think it will carry us well on to March before the river runs dry.

24. *Q.* We have to think about the protection of Bundelkhand, and the first point is to get more water. What chances are there of getting more water from potential reservoirs?—Surveys of the river have been made at different periods since the canal was first mooted, and very elaborate plans were drawn up by Mr. Thornhill, who was Executive Engineer here. He selected various sites along the river extending over 100 miles, and drew up rough estimates of the quantity of water capable of being stored in these reservoirs—eight in number. He selected six sites on the main river, and two sites on the Jamani, which is a branch of the Betwa river, and worked out their various capacities. I have a note of them here (figures handed in to the Secretary).

25. *Q.* Does the Betwa Canal irrigate in Jhansi District at all?—Not much. It is chiefly in Jalaun and a bit of Hamirpur.

26. *Q.* For the famine protection of these districts the first thing you want is more water?—Yes.

27. *Q.* What is about the total storage of these proposed reservoirs of Mr. Thornhill?—4,098 millions cubic feet.

28. *Q.* You have at present 2,750 millions in your reservoir. You could more than double your supply, assuming you could make all these sites?—Yes. As a matter of fact, to sufficiently protect these districts, we want as much more capacity as we have now, *viz.*, another 2,750 million cubic feet.

29. *Q.* You say Mr. Thornhill made out these estimates 20 years ago. Has anything been done recently about them?—I drew out an estimate for one site, the biggest one of those sites, last hot weather. It is the nearest to Paricheha reservoir, and seems to be a suitable place. As far as my recollection goes, the estimate came to seven lakhs of rupees.

30. *Q.* For what storage of water was this?—900 millions of cubic feet; that is, only one-third of the capacity of the Paricheha reservoir.

31. *Q.* That ought to be enough for 60,000 acres?—Yes, I think so, together with the present volume stored.

32. *Q.* Where is that project of yours? Has it gone up to Government?—I think so.

(*Mr. Atkinson.*)—It has not gone beyond Government yet. It was sent up and returned demi-officially.

33. *Q.* (*The President.*)—You recommend it as a thing to carry out, or would you not?—I could not give any direct recommendation or otherwise.

34. *Q.* You look upon it as a promising project?—Yes. We want more water, and this is a suitable place for a reservoir.

35. *Q.* Are you in a position to carry on any more surveys for other sites. You say this one is the largest of them?—Yes. It is the one nearest to the present head of the canal.

36. *Q.* Could one look to getting all these projects thrashed out in a definite number of years?—Certainly, if you had the establishment for it. I have been trying to get up and see one of the other sites, but I have felt seedy, and have not had the opportunity yet. There is a natural reservoir which might be tapped. As to what the capacity is, and what we could get out of it, I do not know yet.

37. *Q.* (*Sir Thomas Higham.*)—Has the cost of these been estimated?—Mr. Thornhill roughly estimated it and Mr. Atkinson has also taken out figures based on his surveys, not on fresh surveys.

(*Mr. Marsh.*)—Our scheme is to go on building them one by one, so as not to do too much.

38. *Q.* (*The President.*)—If you had the money, you would go two by two; would not you?

(*Mr. Marsh.*)—I do not think so; I like to feel my way a bit first.

39. *Q.* (*The President.*)—In the Deccan we found that for this kind of work the great difficulty was the labour. Could you command labour here?—This is simply work for masons. There is very little earthwork to be done.

40. *Q.* Could you command the labour to carry on this work as quickly as you liked?—Yes. You could get your masons from Agra. This is not a good district for labour—not for skilled labour at any rate.

41. *Q.* You do not lay yourselves out for rainy season irrigation at all, I understand?—No. We never have the demand for it. There is no rice practically sown in the district commanded by the Betwa Canal. There is a certain amount sown on the lakes.

42. *Q.* Do you know why it is not sown?—I do not know very much about the actual suitability of the soil, but I have been told that some experiments were made in the Betwa Canal for growing rice in black cotton soil, and it came up very luxuriantly and promised to be a very good crop; but when they came to husk it, there was no grain inside; and certainly, judging from the absence of all rice cultivation in the district, I should think it was not suitable to rice cultivation. I have not seen rice myself on the Betwa Canal beyond a little sown last year from canal irrigation.

43. *Q.* Suppose a demand rose for rice irrigation, there would be no difficulty about supplying it, would there? You could supply it?—The river always comes down about the middle of July, and after that we have no difficulty; but of course the middle of July is rather late for sowing rice.

44. *Q.* You have charge of the lakes too?—Yes.

45. *Q.* How much do they irrigate altogether?—I suppose they do not irrigate more than 5,000 acres between the lot of them. 3,000 acres is, I think, about the average.

46. *Q.* Is there any room for extension there?—Do you mean as regards extension of channels?

47. *Q.* (*The President.*)—Of extending irrigation could you raise *bunds* and so on?—We could extend irrigation in this way that we might economise water more in the cold season and have a little left over for the *kharif*.

48. *Q.* Pursuing the same subject of storage of water, do you know whether these lakes can be multiplied, or can they be enlarged by raising the *bunds*?—The difficulty about the lakes is that in a dry year all of them do not fill up. There is no difficulty about the Jhansi lakes, *viz.*, the Barwa Sagar lake which is fed from a considerable stream and its neighbouring lakes which nearly always fill; but when you come to what are called the Hamirpur lakes, about seventy miles off from here, it is quite another matter. They failed completely this year, and one of them is absolutely dry, being two feet below the sill level of head now. The others are about $\frac{1}{3}$ or $\frac{1}{4}$ full.

49. *Q.* The catchment basin is not large enough for them?—No.

50. *Q.* In an ordinary year would you say that the rain that falls in the catchment basins of these lakes is all put to good purpose? I presume that all the water that is stored

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in these lakes goes out to irrigation?—Yes, every bit of it.

51. *Q.* Therefore I say, as regards the catchment basin of these lakes, all the rain that falls in them is put to good purpose?—Yes, it is all put to good purpose.

52. *Q.* There is nothing to be gained by more storage in these catchment basins?—None whatever.

53. *Q.* Do you happen to know whether elsewhere in this rocky Bundelkhand Province there is any place for water-storage that is not utilised?—I do not know of any from personal investigation, because I have not been over that country very widely, but I have no doubt there are numerous sites where they could be constructed, just like these.

54. *Q.* Has any improvement been done by these little *bunds* at Raksha you were telling me about yesterday?—Undoubtedly. In the village of Raksha itself the spring level of the wells has been permanently secured. They used to run dry before, whereas now they can irrigate in the hot season without any fear of the water-supply giving out. There are 19 of these *bunds*, as you saw in the maps I showed you yesterday. The water percolates from the top *bund* to the lower ones. There is a considerable number of wells below the last one. The water percolates through and supplies the wells below *bund* No. 1—the bottom *bund*.

55. *Q.* In the upper ones do they not sow crops in the tanks themselves when they are empty?—We do not allow them to cultivate the beds of these tanks.

56. *Q.* How much money has been spent upon this; do you happen to know?—I do not know.

(*Mr. Marsh.*)—We can give you those figures; they have all been worked out.

57. *Q.* (*The President.*)—The indirect value of these *bunds* is that they keep up spring water in the wells. What do they do directly or indirectly in the production of food in the country?—Of course they enable people to irrigate their lands, which they could not do otherwise, so there is a distinct benefit done; but as to what the actual area irrigated is now, and what it was before these *bunds* were erected, I could not tell you.

58. *Q.* Have you been impressed with this, so that you would like to extend it?—In this particular instance, as I say, it is only one village that benefits, but I should think where you have a large amount of culturable area below, making *bunds* of that description would add considerably to the welfare of the people and their crops.

59. *Q.* (*Sir Thomas Higham.*)—Suppose people on the Betwa Canal were to take largely to rice irrigation, that would affect the financial position of the canal very favourably, would not it?—Yes, certainly it would.

60. *Q.* Would there be any difficulty in supplying the crops with water? There is plenty of water in the canal?—With our present storage capacity we certainly could not undertake rice irrigation at all in most years.

61. *Q.* Why?—Because last year we only just managed to see the *rabi* through; we did no *kharif* irrigation at all.

62. *Q.* When do you want the water for rice?—They would have to sow their rice with canal irrigation.

63. *Q.* In what month?—I suppose in the month of May and the early part of June.

64. *Q.* What is the latest dates on which water begins to come down the river?—Both last year and the year before it has not been down till the middle of July. Until the water comes down the river we can give no supply. Our supply after the *rabi* irrigation is so small that we can do no irrigation at all some years.

65. *Q.* Then the only reason there is no rice cultivation in the Betwa Canal is because you cannot supply irrigation for it?—Yes, that is the principal reason. Last year, 1901, we had a certain amount of water left over in the reservoir after the *rabi* irrigation, and with that we managed to secure about 200 *bighas* of sugarcane, 180 *bighas* of rice and 100 or 200 *bighas* of various other crops, such as indigo, vegetables, etc. They could take to rice irrigation if they had the water; but as to what area they would actually do, I could not say.

66. *Q.* Is it too late for them to begin rice when the floods come down in July?—I think it is.

67. *Q.* I suppose your canals are not working at all during the *kharif*?—Practically not at all.

68. *Q.* During the months of July, August and September you keep the canals closed?—It is used for the purpose of keeping down weed and silting; it is never used for irrigation.

69. *Q.* You say some attempts have been made to grow rice in *mar* soil?—Yes, so I was told.

70. *Q.* Who were they made by?—The Canal Department. A few were taken up for the purpose.

71. *Q.* They did it for one season?—I think it was only done for one season.

(*Mr. Marsh.*)—For two to three seasons.

72. *Q.* (*Sir Thomas Higham.*)—Is it necessary to suppose, if rice is grown at all, it must be grown in the *mar* soil?—Not necessarily, I should think.

73. *Q.* It will grow in the *purwa* soil very well?—Yes, it will grow there.

74. *Q.* It is not grown anywhere at present?—No.

75. *Q.* Have you any rice at all in the canal? Last year we did about 150 acres of it.

76. *Q.* (*The President.*)—If you could get the people to sow rice when the floods come down, you could give them plenty of water?—Yes.

77. *Q.* (*Sir Thomas Higham.*)—How do you manage to grow indigo if you get no early waterings?—This was done from early waterings. You notice in the year 1900-01 the total amount of *kharif* sown was four acres of sugarcane, eight acres of rice and two acres of other crops. In other years you got nearly three thousand acres. The reason is that the reservoir ran dry. During the present year we were not able to irrigate an acre of *kharif*. They sowed a certain amount of sugarcane before the *rabi* supply was cut off and we were not able to maintain the irrigation of that either. Our canals were closed throughout the whole of the *kharif*.

78. *Q.* They never require irrigation for fodder crops, millets and so forth? In the months of July and August is any water ever required for millets?—I do not think there has ever been a case in which the canals have had to be opened as early as that. In the year 1896-97 the canals were opened in the middle of September.

79. *Q.* You do not open your distributaries for irrigation until the *rabi* demands start, as a rule? What is the harm? If people do not take the water, you can run it off?—But we have got to do our clearances.

80. *Q.* What clearances?—Our annual clearances—silt clearances and repairs.

81. *Q.* You are always dry in March, and you could get plenty of time for clearances then?—Those clearances would not last till October.

82. *Q.* No other canals are closed during the *kharif* for clearances?—But there is no demand for water and we have no water in the first instance. We always open as soon as the demand starts.

83. *Q.* How do you know when the demand is going to start?—We get our reports from patrols and zilladars as in every other division.

84. *Q.* If there is good rainfall, there won't be a demand in August?—No.

85. *Q.* Supposing the rain falls short?—Very likely there will be. This year I thought I should have to open my canals about the 1st of September, because the whole of August was very dry.

86. *Q.* When was the system of charging one rupee per acre for a single watering in September of black cotton soil introduced?—I could not tell you for certain.

87. *Q.* (*Sir Thomas Higham.*)—I want to know if there is an increasing desire or tendency to give the black soil lands a single watering in the months of September or October?—I think there is. They are under the impression once having sown their crops and the crops having sprouted canal water is not very beneficial.

88. *Q.* Mr. Palmer said there were signs that the people are appreciating these September flushings in order to get water on the crop on the black soil?—Not as far as I know.

89. *Q.* Your figures seem to show that there has been no increase in the demand for irrigation?—(Mr. Atkinson showed Sir Thomas Higham a table of figures, and gave some explanation regarding them.)

90. *Q.* Do the Agricultural Department do anything in the way of an experimental farm?—No.

91. *Q.* What is the maximum that your main line can carry?—We can run up to 800 cusecs in the two Branches.

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92. *Q.* If you wanted more?—We could not carry more in the branches.

93. *Q.* Could the main line carry more?—Perhaps 400 cusecs more; we cannot dispose of the amount in our channels.

94. *Q.* As regards lakes, I suppose you have gauges?—Yes.

95. *Q.* How far back do they extend?—Up to 1890.

96. *Q.* Before that there are no records?—I do not think so; they were under the Buildings and Roads Branch.

97. *Q.* Two or three appear to fill every year?—Yes.

98. *Q.* As regards those that always fill, I suppose every year a good deal of water goes into the escape?—Yes.

99. *Q.* Is there any record of that?—No.

100. *Q.* Could they be made to hold up more water?—I do not think the subject has been considered.

101. *Q.* What is the area they irrigate?—I have not got any statement of that; I could give it later. A maximum of 6,000 acres and on the average about 3,000 acres; that is, omitting *kadimi* irrigation on Jhansi lakes, about 700 to 1,000 acres.

102. *Q.* There is no record in detail?—Not here.

103. *Q.* They only irrigate a couple of thousands a year in Jhansi?—Yes, two to three thousands.

104. *Q.* Do they get any revenue?—Yes.

105. *Q.* Do they pay a water-rate?—The rates on Betwa Canal are: Rs. 6-10-8 for sugar, Rs. 4 for tobacco and rice, Rs. 3 for *rabi* crops, Rs. 2 for gram and Re. 1 for paleo per acre. On the lakes the rates are Rs. 3-5-6, Rs. 2-4-0 and Rs. 1-11-0 and Rs. 1-2-0, respectively.

106. *Q.* How do you arrange about distribution; do the people ask for water?—We have rather a complicated system; there are certain *kadimi* rights where no water-rate is charged; it is included in the land revenue and Rs. 1-2-0 respectively on the Barwa Sagar; we levy a water-rate on other lands.

107. *Q.* How do they grow rice?—The Barwa Sagar is never dry; it is the only lake on which they grow rice.

108. *Q.* That revenue is not credited to the lakes?—No, not *kadimi*.

109. *Q.* Do you get anything out of the water-rates to pay for the repair of the lakes and *bunds*?—The revenue is Rs. 3,000 for each set of lakes (statement as regards repairs shown).

110. *Q.* How do you charge for establishment?—There is a certain scale sanctioned by Government; it is the same as in other canal divisions.

111. *Q.* It is impossible to carry out improvements to make them more effective?—I think we can make them more effective in the way of economising water?

112. *Q.* Would they pay?—Perhaps not.

113. *Q.* Do the people take all the water you can give them?—Yes.

114. *Q.* There is always a demand?—Yes.

115. *Q.* Is it proposed to build a new lake anywhere?—Not at the present moment.

116. *Q.* Have you water-rates on the reservoirs?—Yes. We do no direct irrigation on the reservoirs; it is done by distributaries.

117. *Q.* Is there any revenue on the Raksha *bunds*?—No; they only cost Rs. 200 to Rs. 300 for repairs, we levy no rates; they benefit the wells, but we do not claim compensation.

118. *Q.* Are you obliged to keep them up?—I think so.

119. *Q.* Are they kept up by the Public Works Department?—Yes, we have a patrol there; they are under the Sub-divisional Officer and more directly under the zilladar.

120. *Q.* Supposing they had to employ a lot of relief labour now, are there any of these tanks that they could be put on to; I mean *bunds* across nullahs?—It strikes me most of these schemes, such as *bunds* and tanks, etc., have been drawn up rather roughly and without proper investigation.

121. *Q.* Is it not possible to make some useful schemes by famine relief labour if they were properly investigated?—Yes.

122. *Q.* Are there any *bunds* that could be made by famine labour?—Yes. Some of the *bunds* made by famine labour are of no use; sometimes there is no water in the tank at all and at times the *bunds* breach; there are no proper repairs carried out.

123. *Q.* (*Mr. Muir-Mackenzie.*)—What is the reason of the drop in the *kharif* area in 1897-98? It was only 807 acres?—That is probably due to the previous famine year having drained the reservoir.

(*Mr. Atkinson.*)—The *kharif* area of the previous year was very much inflated by the famine.

124. *Q.* (*Mr. Muir-Mackenzie.*)—What is the amount that your present water-supply would enable you to do. You say in your note: "In 1899 only 33,000 acres were done, and of this some 650 acres was destroyed for want of subsequent waterings. There is no reason why as large an area should not have been irrigated as in 1896, *viz.*, 60,000 acres"?—Our present water-storage, if properly economised, should do 37,000 acres of *rabi* and give it a full watering.

125. *Q.* You cannot go further. Then how do you say in your note you can do 60,000 acres?—That was because the year was more favourable; we had rains at the proper time which enabled us to close the canal off; in 1899 the canal ran more continuously; with the same capacity you can irrigate a greater area in one year than in another.

126. *Q.* What is the financial result of watering 37,000 acres? Does the canal pay its working expenses?—That is our average irrigation when there is no extraordinary cold-weather rainfall; our average revenue is Rs. 80,000 and working expenses Rs. 90,000, so the loss on the canal amounts to Rs. 10,000 a year.

127. *Q.* If you had extra storage, do you think you would pay your working expenses?—If we got the full amount of irrigation anticipated, I think it would; it would take some years to develope.

128. *Q.* Are you confident that the demand would have been sufficient,—that you would have got 60,000 acres taken up in a year like 1899?—Yes, certainly; there is no doubt about the demand for *rabi*; the *kharif* is doubtful.

129. *Q.* If you get good years, it will go down again?—Yes, like other canals in these provinces.

130. *Q.* What has been done in the years since 1896-97, 1900-1901?

(*Mr. Atkinson.*)—That was a wet year and 34,000 acres were irrigated.

131. *Q.* On the other hand, you had heaps of water?

(*Mr. Atkinson.*)—Yes.

(*Mr. Marsh.*)—Distribution has been improved a good deal.

132. *Q.* From this extra storage you will not get an increase except in a very bad year?—I think in ordinary years it will go up too; last year there were 48,000 acres irrigated, and it was not a year of drought.

133. *Q.* You attribute the rise to improvements?

(*Mr. Atkinson.*)—To additional storage and improvements in distributaries.

(*Mr. Marsh.*)—We would have got 20,000 acres more if certain other improvements had been sanctioned.

134. *Q.* You look forward to the irrigation of something like 60,000 acres in ordinary years?

(*Mr. Marsh.*)—Yes, provided we get a sufficient cold-weather dry period; in some years there is no dry period between the monsoons and the winter rains.

135. *Q.* What average do you hope for?

(*Mr. Marsh.*)—Up to 50,000 acres.

136. *Q.* (*Mr. Rajaratna Mudaliar.*)—In the early *kharif* could you irrigate any large area if there was a demand for water?—Then, as a rule, we have very little water in our reservoirs; I do not believe we could do more than 2,000 to 3,000 acres; that is in a fair average year.

137. *Q.* Even that is not now irrigated, you are not absolutely certain of it?—No.

138. *Q.* You do not hold up water to meet any subsequent contingencies?—No; we do not consider the *kharif* at all.

139. *Q.* (*The President.*)—I understand from what you have said that of the catchment basins of Bundelkhand only a small area has been utilized for these lakes?—Yes.

140. *Q.* There must be a far greater part of the catchment basins that have not been utilized at all?—Yes.

141. *Q.* Probably there are a great number of these between this and the source of the Betwa?—The country, as far as I have seen, is suitable to the erection of *bunds* of the description of the Barwa Sagar.

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142. *Q.* Would it not be worth while, with a view to increasing the food-supply, to have these *bunds* examined?—Yes.

✓143. *Q.* Now as regards this *kans* grass, you have any amount of water during the rains that you are not using?—Yes.

✓144. *Q.* We have heard that one mode of killing *kans* grass is to embank the field and drown it; would it not be good policy to encourage this kind of thing and tell the people they would get the water for nothing?—Yes, but there would be the expense of making the *bund.*

✓145. *Q.* Do they not take to *bunds*?—In Jalaun they are unknown; in some places in Jhansi they are numerous; in Hamirpur there are none.

✓146. *Q.* Is there *kans* grass there?—Yes, certain parts are depopulated by it.

✓147. *Q.* Suppose the people were offered water free to kill the *kans* grass, would that be of use?—Yes, it would probably be of use, but in some places the grass is mixed up with cultivation.

✓148. *Q.* *Kans* grass is a serious trouble, is it not?—Yes.

Witness No. 39.—Mr. W. J. Riddell, Executive Engineer, Fatehpur Division, Lower Ganges Canal.

Mr. W. J. Riddell.

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1. *Q.* (*The President.*)—You are in charge of the Fatehpur Division?—Yes.

2. *Q.* What other works have you been on?—I was on the construction of the Fatehpur Branch for nearly three years and then I was some time in Naini Tal; I have been in Rohilkhand and in the Northern Division on the head works.

3. *Q.* Your work has been chiefly constructive?—Yes.

4. *Q.* The Fatehpur Division is now open?—Yes, it has been open for three years.

5. *Q.* Is irrigation freely taken?—It is in the Cawnpore District and in the upper portion of Fatehpur; in the lower portion of Fatehpur and in the Allahabad Districts it is taken freely where they have flow, but the cultivators there are very lazy and won't dig *guls* where there is heavy digging; they won't combine to make village channels.

6. *Q.* What are you doing about that? Are you making village channels for them?—A certain amount have been made, but the Government said it was against the usual rule; first there was a small grant of money given, and then they said they could not give more, as the cultivators should do it for themselves. I have been trying this year to get the cultivators to combine, and have said we will dig *guls* if they will pay for them. I am afraid, without applying to the Collector, it would be rather hard to recover the money for digging *guls.*

7. *Q.* Have you been in communication with the Collector about it?—I have spoken to the Collector of Fatehpur, and he said he would try and help me.

8. *Q.* Is there any suggestion about getting *takavi* advances for the purpose of making these village channels?—A grant of Rs. 10,000 was proposed to be given, but there was some difficulty as regards the power of recovery. The difficulty in these matters is that you cannot say exactly who will benefit.

9. *Q.* Have they got any alternative irrigation just now?—They are not used to well irrigation; the people I am speaking about are those living on the borders of the Jumna *banjar* land.

10. *Q.* These people have not ever had a year of drought?—Not since the canal was opened.

11. *Q.* I think this is eminently a thing on which the Executive Engineer and Revenue Officers should act together. As a rule, how long would the longest village channel be?—It has been our endeavours to have nothing over one mile.

12. *Q.* Is there *reh* or *usar* land in this country?—There is a certain amount of *usar*, but not in very large quantities.

13. *Q.* Has it been necessary to make any drainage lines yet?—No big drainage line is required.

14. *Q.* In these new distributaries I suppose you fix the size and number of outlets?—Yes. The proportion we are allowed to provide irrigation for in each village is 40 per cent. of the culturable area; that is, including well irrigation.

15. *Q.* In the two crops?—Yes, but our *kharif* crop is very small.

16. *Q.* If a man owning land within a mile of your distributaries wants irrigation, does he send an application to you?—Yes, if there is not a distributary that goes near his land.

17. *Q.* Supposing there is a distributary a mile off, does he state the approximate area that he means to cultivate?—If there are 100 acres commanded in the village, we are allowed to irrigate 40.

18. *Q.* No rayat is given any particular amount?—No, it is given to the village. The distribution they arrange among themselves. Supposing, however, we had only 50 per cent. of the area of a village commanded by the canal, in order to get 40 per cent. of the total culturable area, we allow for the irrigation of up to 60 per cent. of the total commanded area.

19. *Q.* How many sizes of outlets are there?—6″, 5¼″ and 4½″ discharging into a 12-inch barrel. We are just starting iron pipe outlets.

20. *Q.* As yet you have got very little *kharif*?—Yes, the indigo which was reckoned on to give a large area has gone; they are increasing sugarcane cultivation every year.

21. *Q.* Are they taking to rice?—They have a good number of *jhils* which serve them for rice, but the water in these *jhils* does not last into the *rabi*; they have not a good class of rice.

22. *Q.* Is there anything you would like to bring to the notice of the Commissioner; if so, we shall be glad to hear it?—There is one matter as regards the shortness of our staff; we are handicapped, because there are so many native upper subordinates in charge of sub-division.

Witness No. 40.—Mr. H. Spencer, Collector of Hamirpur.

Mr. H. Spencer.

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1. *Q.* (*The President.*)—You are Collector of Hamirpur?—Yes.

2. *Q.* How long have you been there?—Over three years.

3. *Q.* What measure would you recommend as the best to help Hamirpur in the event of another famine?—There is nothing more promising than the Dassau project; it is absolutely the best.

4. *Q.* What is your opinion about the irrigation of *mar* soil?—There is a strong prejudice against it down in these parts where they have never tried irrigation; up in the north of the district during the last famine they learnt to irrigate it and have girriated some this year from the Betwa Canal.

5. *Q.* Do you think there is reason to suppose that by degrees they will get into the way of irrigating it?—There is *mar* and *mar*; the heavy black soil they will never irrigate; *kabar* is already irrigated from wells whenever the water is near enough.

6. *Q.* Do the people look forward to the Dassan project?—Yes, I have just marched down the line of canal and find that except in three villages, they are all very keen about it.

7. *Q.* What is the objection to it there?—In two of them there is nothing but *mar,* and they think, if a canal is brought, they will lose their land and get no compensating advantage; in the other case, the man wants to keep the jungle for his cattle.

8. *Q.* Have you got any lakes in your district?—Yes, in some places.

9. *Q.* Is there any irrigation of consequence done by these lakes?—The Jaitpur, Bela Tal and Bijainagar do a good deal.

10. *Q.* Do you think there is any field for extension of such lakes?—There are remains of old ones that have been breached and never mended, which no doubt would hold water; I cannot say if this would ever pay. There is the drawback that if the rains do not come in time, your lake remains dry.

11. *Q.* (*Mr. Muir-Mackenzie.*)—Have any of them ever been dry?—The level was extremely low in most of the cold weather before last; in the famine they were well filled by the early rains; they are rather low this year.

12. *Q.* (*The President.*)—Have you got a great deal of trouble with *kans* grass?—Yes, it has done a lot of damage.

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13. *Q.* Do you know any remedy for it?—Flooding is the best thing.

14. *Q.* Have you seen it tried?—Yes.

15. *Q.* With good results?—Yes, two or three fields are shut in by a *bund*. It takes two or three years to flood out the *kans* grass.

16. *Q.* How high is the *bund*?—5 to 6 feet high on fairly flat ground.

17. *Q.* Do you think, if the Dassan Canal were made, the people would avail themselves of the surplus water to kill the *kans* grass?—I think so.

18. *Q.* Have you got much well irrigation in the district?—In the north of the district there is hardly any; there is more in the south; 17,240 acres were done by 7,452 wells. (Statement handed in.)

19. *Q.* We have had figures given us showing 20 acres of irrigation per well in Oudh?—I have nothing of that kind; I have worked it out to 1·25 acres per *pakka* well; *kachcha* wells simply do a *bigha* or so.

20. *Q.* Are the wells liable to fail?—In May and June it is often reported that the wells are dry.

21. *Q.* Has anything been done in the way of deepening the wells?—Now and then *takavi* is given.

22. *Q.* Do you give much *takavi*?—Not much.

23. *Q.* Could you give more if you had more?—No.

24. *Q.* Mr. Bell said yesterday there was a limit as to the amount of *takavi*?—My people are not keen about it.

25. *Q.* Is there any feeling against the formalities of rigidity of recovery?—I think rigidity of recovery has more to do with it than *dasturi*.

26. *Q.* How many years do you spread payments over?—We can run up to seven or eight years, but you expect to make the ordinary recoveries of Rs. 70 and Rs. 80 under five years.

27. *Q.* (*Mr. Muir-Mackenzie.*)—What is a seven-year case?—That would be deepening a well or making a small *bund*.

28. *Q.* How much money do you advance in an ordinary year?—I do not think I can tell you off-hand; probably Rs. 5,000 to Rs. 6,000.

29. *Q.* Could you increase that, do you think?—It is difficult to go round and look up the promising sites.

30. *Q.* Has anybody ever taken the trouble to go round?—At Kabrai a lot of *bandhias* had been proposed as famine relief works, and people applied for advances to make them for their own use.

31. *Q.* If the matter was stimulated by somebody going round, perhaps there would be a little more keenness?—Probably that is the way it will have to be done.

32. *Q.* To whom would you advance,—small zamindars?—They are nearly all petty zamindars.

33. *Q.* You would not advance to tenants?—The tenants would not think of making an improvement; they shift from one holding to another and do not care at all about occupancy rights.

34. *Q.* As regards these wells in the south of the district, who made them?—I could not say off-hand; they were probably made by zamindars.

35. *Q.* There are a few large zamindars?—Yes, and those who are large are non-resident.

36. *Q.* As regards relief works, how much of the population have you provided for in your programme?—30 per cent. for six months, except in just one corner where no works are forthcoming; we could extend it to twice that amount; there is no difficulty in providing works.

37. *Q.* What are your works chiefly?—Tanks.

38. *Q.* For water-supply?—Yes, for cattle and people.

39. *Q.* Have you got any *bandhias* in the programme?—Yes.

40. *Q.* Would you not be inclined to do more in that way?—It is very hard to select them.

41. *Q.* If by chance you got a series of decent years and had time to prospect the country, do not you think you might get a number of these works profitably done?—Yes, in the south of the district.

42. *Q.* Would they make a good form of relief work?—Some masonry sluices are required: I rejected over 20 per cent., as they were really not relief works.

43. *Q.* You would not expect any difficulty in organizing work at the time of famine?—I do not know if any was felt.

44. *Q.* Have you done any famine work?—I was merely inspecting works in progress in Muttra.

45. *Q.* Had you any village works to do?—I did nothing but inspection.

46. *Q.* (*Mr. Rajaratna Mudaliar.*)—What enhancement of rent does a zamindar get if he makes a well?—He never applies for an enhancement, because if he did, the tenant would simply go away.

47. *Q.* It would be profitable to irrigate if there are wells to raise valuable crops?—He lifts water if he can get it easily.

48. *Q.* Is that the reason why the average area per well is low in this district?—The depth of water is the chief cause.

49. *Q.* What is the depth?—In the northern district it is anything from 60 to 120 feet.

50. *Q.* (*Mr. Roberts.*)—In regard to *takavi* the question has been raised whether the difficulties in extending grants were not due (1) to the extortion practised; (2) the rate of interest charged; and (3) repayment not being extended over a sufficient number of years. Have you felt these difficulties? Is extortion practised?—There is only the usual amount of Rs. 2 given to *patwaris*, and there is the tahsil percentage.

51. *Q.* Added to the interest does that make it prohibitive?—I do not think so; the chief difficulty is the rigorousness of recovery.

52. *Q.* The rate of interest is not objectionable?—No.

53. *Q.* Then as regards rigour of recovery, you said that the ordinary period of recovery is five years; the Board circular allows up to 15 years; supposing you went up to the full 15, would that make *takavi* more sought after?—I should be sorry to give an opinion.

54. *Q.* What is the difficulty in extending the period?—You have to keep a sharp eye on your security in the case of a long period; many cases have been recommended for remission where land hypothecated has passed through several hands.

55. *Q.* It would increase the difficulty of ultimate recovery if the time were greatly extended?—I think so.

56. *Q.* (*Mr. Rajaratna Mudaliar.*)—Could they not sell the land?—The Board would not have it.

57. *Q.* (*Mr. Roberts.*)—Have you had any difficulty in getting as much *takavi* as was required?—No.

58. *Q.* What amount could be profitably expended in *takavi* in making *bandhias*?—I cannot say.

59. *Q.* Are the people too poor to make them of their own accord?—There are a lot of small *bandhias* made that way.

60. *Q.* They do not require masonry?—They are simply earthwork.

61. *Q.* (*Mr. Rajaratna Mudaliar.*)—What is the time taken in disposing of *takavi* cases; is it under two months?—It could be done quicker if a man would go to the tahsil and press his case.

62. *Q.* (*Mr. Muir-Mackenzie.*)—And still quicker if a man were on the spot to enquire into cases and distribute *takavi*?—Yes.

63. *Q.* For *takavi* for land improvements and construction of wells they can put in applications at any time?—Yes.

64. *Q.* Are these disposed of within two months?—Yes, I think so; the longest part of the enquiry is into the circumstances of the surety.

65. *Q.* (*Mr. Muir-Mackenzie.*)—Your well irrigation in Hamirpur increased very little in the famine year?—Perhaps that is because we could not make *kachcha* wells.

66. *Q.* What are your *pakka* wells like; are they dug through rock or are they in clay?—Both. Three-quarters of the district has no rock.

67. *Q.* Your *pakka* wells have bricks right down?—Yes.

68. *Q.* Are they made with mortar?—Some have not got mortar.

69. *Q.* Are these figures right; 9,500 *pakka* wells, 1,300 *kachcha* wells?—Yes.

WITNESS No. 41.—THAKUR BENI SINGH, Lambardar, Mataundh, District Banda.

Thakur Beni Singh.

4th Dec. 02.

(*To the President.*)—I am Lambardar of Mataundh village, of which the area is 32,000 *bighas*. One-third of the *jama* is remitted in perpetuity for assistance rendered to Europeans in the mutiny. Wells in my zamindari are 75 feet deep. There are field embankments which are made by cultivators. Zamindars are afraid of taking *takavi*, because they cannot pay it back in a dry year. The mahajans let the repayment stand over till good years come. If the zamindars were given 10 or 12 years to repay, they would take *takavi* readily. It takes two years before they get any return from embankments as regards killing *kans*. A canal from the Ken river would be a great advantage. The soil is *mar*, *purwa* and *rakar* in my village, and there is much *kans*. This year there is great distress owing to want of water for cattle. I have a tank, which, if the neighbouring stream were turned into it, could irrigate 600 acres of land. It would cost Rs. 3,000 or 4,000 to do this. We would pay water-rate. I own only a 3-anna share of the village which has 350 co-sharers. If I could get the others to agree, I would take *takavi* improvements. Government would have to assist in the construction of the work; the people could not do it without such aid, as they cannot combine. I could make it without professional assistance if the whole of the land was my own property. I have made one embankment costing Rs. 1,100; this was made chiefly to kill *kans*. Embanking doubles the outturn of the land and saves labour in ploughing. It costs about Rs. 5 per acre.

WITNESS No. 42.—BABU NARSING DAS, Lambardar of Talbehat, District Jhansi.

Babu Narsing Das.

4th Dec. 02.

(*To the President.*)—In my zamindari the soil is rocky and kankarey and red, which is irrigated from wells and in which, by saving one maund, eight or ten maunds are produced, and one well irrigated three or four acres. In the famine I had to take *takavi* to dig new wells. Besides this I have an old tank which always holds much water, and which produces per annum nearly Rs. 500 of *singharas* and Rs. 500 of *satia* (hot-weather rice), and *dhán* (rainy season rice). This tank, even when the rains fail, is 30 or 40 feet deep, wherefore none of the wells of the village go dry; and when in any year there is a famine, thousands of poor people live on the *morar* (roots of the lotus), *kamal* (fruits of the lotus), *surkha* (a water plant), *kaseru* (another water plant), grass (*i.e.*, by cutting and selling it).

WITNESS No. 43.—PANDIT MADHO PERSHAD, of Gabrauli, District Hamirpur.

Pandit Madho Pershad.

4th Dec. 02.

(*To the President.*)—We should like the Dassan Canal if it will give us water when we want it. In the famine years the people of my village got plenty of *takavi*, much of which was remitted, and this way they were kept alive. There is a great deal of *mar* soil; therefore there are no wells; there is no need for them. There are some wells, in *kabar* and *purwa* soils, but we are not accustomed to watering fields; the water is 60 feet from the surface. A canal would be the only preventive of famine, but we cannot irrigate *mar* even in famine. We get crops in *mar* soil even in the famine year.

TWENTY-SECOND DAY.

Jhansi, 5th December 1902.

WITNESS No. 44.—MR. C. A. SILBERRAD, Sub-divisional Officer, Lalitpur.

Mr. C. A. Silberrad.

5th Dec. 02.

Additional note on Irrigation in Jhansi (more especially in Lalitpur).

I.—Details of some tanks made by zamindars with the aid of ordinary or famine *takavi* in the years 1895—1897 and 1899-1900.

(*a*) *Bant* (*Balabehat*).—Besides the Public Works Department tank, there is a tank, or more correctly, large *bandhia* repaired by the zamindar with the aid of Rs. 441 *takavi* in 1895-96. This tank enables some 35 acres of rice (irrigated or not, according to season) to be grown below the tank, and gives some 40 to 50 acres of *rabi* in its bed. It is estimated (a good deal of the land is *khudkasht*, and some is held by hereditary tenants, whose rents have not been enhanced) to have increased the annual value of the village by about Rs. 100.

(*b*) *Sirsi* (*Bansi*).—A tank here was repaired by the zamindars with the aid of Rs. 600 ($\frac{3}{4}$ths recoverable famine *takavi*). In 1309 F. 14 acres were irrigated directly from the tank, but the total (well) irrigated area in the village has increased as follows:—

1306	168 acres.	1308	153 acres.
1307	129 acres.	1309	196 acres.

(*c*) *Menwar* (*Bansi*).—Rs. 1,000 *takavi* was advanced in 1899 to the zamindars to repair a tank. Channels for irrigating from it have not yet been completed, but its influence is shown in the following figures for well irrigation:—

1306 F.	148 acres.	1308 F.	160 acres.
1307 F.	134 acres.	1309 F.	177 acres.

(*d*) *Nanora* (*Bansi*).—Rs. 400 was advanced in 1307 to the same zamindar as in the preceding case. Here, also, there is no *direct* irrigation, but the figures for well-irrigation are—

1306	151 acres.	1308	166 acres.
1307	134 acres.	1309	188 acres.

(*e*) *Rajwara* (*Lalitpur*).—Rs. 630 was advanced in 1307 for the repair of a tank, which has resulted in an increase of 50 acres of irrigation from the tanks.

(*f*) *Agori* (*Maraura*).—Rs. 1,000 *ordinary takavi* was advanced in 1307, the zamindar spent an additional Rs. 200 in the next year, and he tells me himself that his income from the village last year has increased by Rs. 150 in consequence of the tank.

Some cases have been of course more or less failures, generally owing to the bursting of the tanks, *i.e.*, the zamindars were not sufficiently skilled to ensure safety.

II.—I give in detail the average settlement, wet and dry rates for the various kinds of soil in each pargana of the district (in rupees per acre)—

Mr. C. A. Silberrad.

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Jhansi Proper. (*Re-settled 1892 to 1894.*)

PARGANA.	MAR.		KABAR.		PURWA.		RAKAR MOTI.		RAKAR PATHRI.	
	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.
Jhansi . . .	6·7	5·06	5·33	3·7	3·99	2·72	3·23	1·63	2·12	·76
Man . . .	...	3·45	4·01	2·66	3·91	1·84	3·72	1·58	2·11	·82
Garotha . . .	...	3·88	...	2·99	...	2·11	...	1·60	...	·95
Moth . . .	...	4·03	5·24	3·43	4·17	2·56	2·0	1·71	...	·94
Average . . .	4·56	3·87	5·04	3·14	3·95	2·28	3·31	1·63	2·11	·81
Ratio of wet to dry rate .	1·18		1·60		1·73		2·03		2·6	

Lalitpur. (*Re-settled 1896 to 1898.*)

PARGANA.	MOTI.		DUMAT.		PATHRI.	
	Wet.	Dry.	Wet.	Dry.*	Wet.	Dry.†
Balabehat	...	1·50	3·44	·94	...	...
Bansi	...	2·00	4·37	1·06	3·5	·75
Lalitpur	...	1·37	3·69	1·06	3·19	·75
Talbehat	...	...	4·00	·75	2·87	·56
Banpur	...	2·00	3·62	·94	2·69	·75
Mahroni	...	1·37	3·75	1·69	2·75	·69
Maraura	...	1·75	2·56	·81	2·06	·69
Average	...	1·66	3·5	·94	2·81	·62
Ratio $\frac{\text{wet}}{\text{dry}}$	...		3·73		4·5	

* Cultivable for 5 to 6 years and then usually fallow for the same period.

† Ditto 3 to 4 ditto ditto 8 to 12 years.

To a certain extent the *moti* of Lalitpur corresponds to the *mar* and dry *kabar* of Jhansi proper; the *dumat* to wet *kabar*, *purwa* and dry *rakar moti*; *pathri* to wet *rakar moti* and *rakar pathri*.

The following table illustrates the fact that in the settlement circles containing the largest proportion of black soil this soil is very far from being the only constituent of the circle:—

Percentage (*of cultivated area*).

Circle.	Mar.	Mar and dry kabar.	Purwa, wet kabar, and dry rakar moti.	
Jhansi I . .	23	61	38	Jhansi proper.
„ II . .	11	37	45	
Man (IV—VIII) .	50	81	17	
Garotha I . .	60	79	17	
„ II . .	47	77	17	
„ III . .	52	81	12	
„ IV . .	40	74	17	
Moth (whole tahsil) .	23·5	71	25	

Circle.	Moti.	Dumat.	Pathri.
Lalitpur I . . .	59	30	9
Banpur I . . .	50	39	11
Mahroni I . . .	53	32	4
Maraura I . . .	53	25	12

It must be remembered that, save in Garotha, Moth, and part of Man, the black soil circles are not by any means a predominant portion of the cultivated area.

III.—*Details of the Pawa tank.*—This was constructed first in 1868-69 famine, but the *bund* burst in the rains of 1869. It was reconstructed seven years later, the zamindar taking Rs. 3,000 *takavi*, and the services of a Naib Tahsildar being lent to supervise the work; the work done in 1868-69 had to be entirely removed before reconstruction. Some Rs. 800 or 900 of the total *takavi* was remitted.

The water is held up till the time for sowing *rabi*, and then let off and the bed sown. In 1309 the area so sown was 63·42 acres; the land is let on the *batai* system; *i.e.*, tenants and zamindars each take half the produce. The zamindars' half converted into cash at current rates was recorded by the *patwari* (and stated by him to me *in presence of the zamindars*) as Rs. 700 in 1309; and between Rs. 500 and Rs. 600 in 1308. These figures are borne out by the settlement officer's note that at the time of his inspection the land was leased at Rs. 10 per acre.

In the settlement records of the 1860-67 settlement the land now benefited by the tank is recorded as *dumat*, and its total rental as Rs. 115. This gives an annual return of some Rs. 500 on an outlay of Rs. 3,000, or nearly 17 per cent. (the work done in 1868-69 appears to have been quite valueless).

The site is undoubtedly unusually favourable (a stream running through a gorge in a line of hills), but the above figures of profit leave a considerable margin.

The Raksa bunds.—(Information derived from the *patwari* and Diwan Udot Singh of Raksa.) Constructed in 1888 at a cost of some Rs. 9,250. The irrigated area (from wells) has increased since settlement (1892) by some 40 acres, and 14 acres are irrigated directly from one of the tanks. Four additional wells have been made, and these and 20 others in the village have now a better supply of water (water-level is said to have been raised 12 ft.), so that

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instead of beginning to fail by February (and so not being able to properly supply the ripening crop) there is always a good supply, even in famine years. Udet Singh (who owns 4 acres of Raksa) estimates the ordinary increase in annual value to the zamindars from the land at Rs. 100, with another Rs. 100 in a famine year. It would be more were not a good deal of the land benefited held by *maurusi* tenants, enhancements in Jhansi at present being practically impossible.

Udet Singh says there is a more favourable site for a series of *bandhs* on the Kapra Nadi, which, he says, would cost some Rs. 20,000, and would benefit villages as follows: Sijwaha Rs. 100; Raksa Rs. 500; Kotkhera Rs. 150; Palinda Rs. 20); Dongra Rs. 100; Pathau Rs. 50; total Rs. 1,100. I cannot say anything more of this idea from personal knowledge.

IV.—The following figures are interesting as illustrating the value of tanks. I take the red soil (pathri), Pargana Talbehat.

The settlement *rabi* area (1304) was 12,567 acres, and that is a fair average for this pargana, which is quite unaffected by *kans*, there being no black soil. In 1307 the *rabi* area was but 9,612 acres,—a fall of 23·4 per cent. in this pargana there is practically no unirrigated *rabi* (irrigated *rabi* is 88 per cent. of the whole): this fall was almost entirely due to lack of water in wells. But in Talbehat village, which is thoroughly protected by a large tank which never goes dry, the *rabi* area only dropped from 1,028 (settlement) to 1,010 acres in 1307, while the irrigated area *increased* from 867 to 986 acres.

Pawa showed a decline of *rabi* area of but 9 per cent., and of irrigated area of 7 per cent.

Jakhora (in Bansi, but very similar to Talbehat) showed an *increase* of *rabi* area from 358 acres at settlement to 471 acres in 1307.

As regards the black soil, I am now camping in the black soil portion of the Lalitpur Sub-division, which, however, differs from the black soil of North Jhansi, Jalaun, etc., in being undulating and interspersed with much more *dumat*. Here, too, I find a very general desire for irrigation. As an example, the rumour of a weir on the Betwa at Deogarh (one of the proposed storage weirs for the Betwa Canal) has spread, and I have been repeatedly asked whether a canal cannot come to this or that village, which, of course, the undulating character of the country would render impossible. Then I am asked if one of the smaller rivers could not be dammed, or, failing that, if a tank could not be made. I have already found several suitable sites for small tanks to supply one village *in this part of the sub-division;* in one village the zamindars have given in a written application agreeing to pay 5 per cent. on capital cost *plus* 2 per cent. for annual repairs; this is but a small tank, cost about 600, but this particular village is small; in several others (in the same tract, *i.e.*, 'black soil') zamindars have said verbally they would do so. The soil commanded by these tanks would be mainly *dumat*, but this bears out my contention that suitable sites could be found in this part of Lalitpur.

V.—I have seen the Bundelkhandi so often reproached with laziness that I would like to urge in partial excuse for him that the soil of Bundelkhand is, as a rule, such that with a good season it will give an excellent crop with little exertion, while in a bad one no amount of exertion will make much improvement. The irrigated centres in a red soil village (round the site) are, I think, as carefully cultivated as land is on an average in the Doab.

VI.—As regards *takavi*, I would like to place on record an idea that I have that the reluctance sometimes noted in taking *takavi* is greatly due to the uncertainty of the amount that will be distributed; with continuity in 3 or 4 years some Rs. 8,000 or Rs. 10,000 *takavi* for seed was easily distributed in the sub-division every *rabi*. In the first year, when the amount for distribution is short, application for a large sum of *takavi* had to be filed.

VII.—As regards rice, for the gazetteer I collected information concerning 16 different kinds grown in the sub-division; none of these were described as growing in *moti* in fact in Lalitpur, and I think it is the same in Jhansi proper; rice is practically never grown on black soil. Thus with an average of 8 per cent. of the *kharif* area of Lalitpur under rice in Talbehat Pargana, which contains *no* black soil, rice forms 16 per cent., while in Mahroni Pargana, with approximately equal areas of black soil, *pathri* and *dumat* rice is only 4 per cent. of the *kharif* area.

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1. *Q.* (*The President.*)—You have been 4 years in this district?—I came in March 1899 and have been here pretty well continuously since.

2. *Q.* Where were you before?—In Etah in the Agra Division, in Etawah, Farrukhabad and in Muttra.

3. *Q.* Is there any irrigation in Lalitpur?—There are tanks and there is some irrigation from them.

4. *Q.* Is there any record of it in the statistics?—There is a statement in the settlement records and the pargana registers, but you cannot say accurately how much is from tanks and how much from wells, as much of the irrigation really derived from tanks is done directly from wells below the *bandh* of the tank which are indirectly fed by it. Such irrigation should obviously be almost wholly credited to the tank.

5. *Q.* Was the famine of 1896-97 severe there?—Yes; I was not there for the famine.

6. *Q.* I suppose wells held out?—I believe they did; I believe the water-supply held out better than in the 1899-1900 famine.

7. *Q.* Was there severe distress in 1899-1900?—Fairly so, but not as great as in 1897.

8. *Q.* Were there relief works in both cases?—Yes.

9. *Q.* (*Mr. Muir-Mackenzie.*)—How many people were there on relief in 1899-1900?—I think the maximum was 7,000 to 8,000 on one day.

10. *Q.* (*The President.*)—The population is very scattered, I suppose?—Yes, 210,000 for 1,940 square miles in Lalitpur.

11. *Q.* And what is it in Jhansi?—400,000 for 1,500 square miles.

12. *Q.* Is there much scope for the extension of wells?—Yes, there is, but tanks are more necessary, so that the water-level may be maintained; the country is mainly divided into a series of rocky valleys underlain by impermeable rock; the water-supply of each such valley is derived solely from the rain falling within its limits, *i.e.*, there is little or no underground supply soaking through from elsewhere.

13. *Q.* The extension of tanks is, you think, better?—It is almost a necessity, I think, before you can extend your wells to any extent.

14. *Q.* The chief function would be to act indirectly to keep up the spring level of the wells?—Not the chief function, but an important function. There are many places where more tanks could be made.

15. *Q.* There is no doubt about that?—No.

16. *Q.* Would these be large tanks or small ones?—They would for the most part not be more than sufficient to supply one village; I have been lately over a good many villages in the northern part of the Sub-division; there is a good site in nearly every village. I proposed that Government should construct the tanks and that they should pay 5 per cent. on the capital cost and annual repairs; some agreed to this, but some did not.

17. *Q.* Would it not be better done by *takavi*?—I don't think they could do it. The Nathikhera tank burst the rains before last and the zamindars got *takavi* amounting to Rs. 500 to mend it; they kept it for four or five months and then said they could not manage it and returned the money. The zamindars have twice before repaired this tank.

18. *Q.* I suppose there is a District Engineer for the works?—There is in Jhansi.

19. *Q.* Could a subordinate be trusted with that kind of thing?—I should hardly say so.

20. *Q.* The Irrigation Department seems rather heavy machinery for that if it can be done without?—Perhaps so, but you want some one who is a specialist on tanks.

21. *Q.* Would you like to see a system such as you describe carried out by the Public Works Department?—There should be a proper survey and inspection of these sites in consultation with the zamindars concerned to determine whether they would pay. If there was an officer of the Irrigation Department in charge of all tanks, they would be maintained regularly.

22. *Q.* Would there be any revenue difficulties about the zamindars paying 5 per cent. of the cost?—Some say they would do it; others say that the advantages are not sufficient. Irrigated rent is $3\frac{1}{2}$ times that of unirrigated.

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23. *Q.* Would there be difficulties made about the land submerged by such tanks?—No, if the scheme I had thought of were adopted. Government would allow the zamindars to use the tank, provided they did not damage it just as they pleased.

24. *Q.* (*Mr. Muir-Mackenzie.*)—You have concluded a certain agreement?—No; I was proposing that tanks should be constructed and maintained by Government; the zamindars should pay 5 per cent. on the capital cost, *plus* the annual cost of repairs, and that zamindars should be allowed to use the water as they please, provided they did not do any damage to the tank.

25. *Q.* (*Sir Thomas Higham.*)—Have you any idea of the expenditure necessary to protect this particular area?—These tanks would be small ones and not more than sufficient to command part of the land of one village; they would cost from Rs. 500 to Rs. 3,000.

26. *Q.* Hamirpur has 203 acres for every million cubic feet; that seems quite as much as you could do. Where would the 5 per cent. come from?—From the increased rent of irrigated land as compared with the same land unirrigated, thus the average Settlement Officer's circle rate for wet *dumat* is 3¾ times the dry rate; for wet *pathri* 4½ times. Moreover, quite half the advantage is from wells below the *bandh*.

27. *Q.* That is why you cannot put a water-rate on it?—Yes.

28. *Q.* If the people could pay 5 per cent. on the capital cost and the cost of maintenance, then these would be productive works?—A tank at Parwa cost Rs. 3,000 and the zamindars estimate that the benefit from it is Rs. 500 to Rs. 700 a year.

29. *Q.* (*The President.*)—Who made it?—This tank was originally constructed in the 1868-69 famine. It burst in the rains of 1869; and was reconstructed 7 years later; the zamindars taking Rs. 3,000 *takavi*, of which some Rs. 800 or Rs. 900 was finally remitted. The work done in 1868-69 was of no assistance, the whole having had to be done over again. The water is held up till the time of sowing *rabi*, and then let off and the bed sown.

30. *Q.* (*Mr. Muir-Mackenzie.*)—How do you know that it costs Rs. 3,000?—I have been told so.

31. *Q.* (*Sir Thomas Higham.*)—Such tanks are very like field embankments?—They let the water out at the beginning of the cold weather and sow their wheat.

32. *Q.* (*The President.*)—What would you advocate for Lalitpur as the best means of enabling it to resist famine?—I would have a careful survey made of these tanks and of the different sites in consultation with the zamindars of the village so as to ascertain whether it would suit them to have a tank, and these projects should be carried out as funds might be available.

33. *Q.* Do you think storage of water on a large scale would assist Lalitpur?—It might keep up the water-level, and you might take small canals out of such reservoirs, but the country is too hilly for a large canal to be possible.

34. *Q.* Have you thought of large storage works in that district for irrigation?—Yes.

35. *Q.* Do you think there are possibilities there?—It looks as if it should be possible.

36. *Q.* The red soil of Lalitpur is poor soil?—Yes, the Settlement Officer's average rate for cultivated dry *pathri* is 11 annas per acre; but such soil is usually cultivated for only 2 or 3 years, and then lies fallow for 8 to 12.

37. *Q.* Is it the same as that which is irrigated?—Yes, I believe it is, by long cultivation and manuring it has become better soil than it was before.

38. *Q.* Do not tanks silt up much?—I don't think they do; certainly some of the Chandel tanks have to some extent silted up, but they are probably 800 to 900 years old.

39. *Q.* Do the people look after the existing tanks themselves?—Yes, so far as they are looked after at all.

40. *Q.* Do they do repairs?—Sometimes, not always.

41. *Q.* Are there masonry sluices?—In some a good many have natural escapes.

42. *Q.* Do they irrigate *kabar* land at all?—In Bant they do; it is called *moti* and includes *mar* and *kabar*.

43. *Q.* What is the reason why that village does it and not others?—The tank is well situated; it was built in the 1869 famine; it burst in the rains of that year, and was repaired about 1890. Irrigation from it only began in 1899, but before that it had done much to raise the spring level and keep land near it moist and so capable of bearing spring as well as autumn crops.

44. *Q.* Do you consider it the duty of Government to repair the tanks?—Yes, where there is a prospect of advantage commensurate with the outlay.

45. *Q.* (*Sir Thomas Higham.*)—As regards these tanks that you propose, have you any idea of the cost?—Some have been roughly estimated as civil famine relief works.

46. *Q.* Have you got a number of these tanks in the programme?—Yes, but those in the list are generally not the right ones. The list was made out by the Tahsildar based on Kanungo's report. I am going through the proposals, inspecting the localities and writing notes.

47. *Q.* Has it been examined by any of the Public Works Department officers?—No. (Report by Captain Bellasis shown to President.)

48. *Q.* (*The President.*)—Your remarks about tanks in Lalitpur would apply equally well to the other parts of the Jhansi District?—In the flat land it would not apply, but it would to the southern portions of parganas Jhansi and Mar. (Some conversation in connection with programme.)

49. *Q.* (*Sir Thomas Higham.*)—I suppose you made some tanks in the last famine?—No, they only deepened two or three.

50. *Q.* You cannot say what was the result?—No; I can obtain some details, I think (that is what was said, but I don't believe it).

51. *Q.* Instead of 5 per cent., if you could get half, I think there would be a very good case for the money?—I think they would pay 2½ per cent. certainly.

52. *Q.* I suppose tanks very often burst?—Yes, very often.

53. *Q.* That is because there is no escape?—Yes, sometimes, but often through neglect of the *bandh* which bursts where it has been allowed to become weak.

54. *Q.* The escape generally costs as much as the *bandh*?—In a good many places you can get a natural escape over rock.

55. *Q.* Is this programme complete?—No, that is what I have been able to do this season.

56. *Q.* What did they spend on the Raksa *bandhs*?—Rs. 9,337.

57. *Q.* If you wanted 5 per cent., it would be about Rs. 600; nobody could get that out of them; could they?—I don't know what has happened by increase of revenue in the last settlement of 1892. I will try to find out and send it in.

58. *Q.* I think, if you could be sure of getting your 5 per cent. at the next settlement, it would be good enough?—I think it could be done if the tanks were chosen properly.

59. *Q.* How many works of this kind have you got (pointing to programme)?—There are several hundred tanks and *bandhias*; by tanks I mean *bandhs* put across the drainage lines.

60. *Q.* What do you propose about the *bandhias*; should these be done by Government?—Yes, I think this would be best; somewhat as suggested in Mr. Barlow's report.

61. *Q.* Would the people do it themselves?—They do sometimes.

62. *Q.* Would you confine Government work to the making of tanks?—No. In Lalitpur even in those settlement circles containing most black soil, this soil rarely amounts to more than half the cultivated area. I think in a great many places sites could be found for tanks whence the people would irrigate *dumat*, that is a mixture of red and black soil.

63. *Q.* Do they irrigate where there is black soil?—No.

64. *Q.* If you put your tank where there is black soil, they won't use the water; will they?—A big zamindar in Lalitpur said they would very probably use the water to irrigate black soil, but for the first watering only.

65. *Q.* Would they lift it?—No.

66. *Q.* (*Mr. Muir-Mackenzie.*)—There are already a great many wells in Lalitpur?—In red soil in the valleys.

67. *Q.* Not under tanks?—Yes.

68. *Q.* Do wells not protected by tanks hold out as well as others?—Not as well; in the 1899-1900 famine in Talbaid in the red soil the *rabi* area was only 75 per cent. of the normal; the *rabi* there is all irrigated by wells or tanks.

69. *Q.* Were tanks useful ?—Villages that suffered most were certainly those that have not got tanks.

70. *Q.* Now looking at some figures I have, I should like to ask, why more relief was not given in 1899-1900 ?—We were perhaps not very liberal.

71. *Q.* If relief had been given with greater liberality, perhaps you could have relieved more ?—Yes, but I do not wish to be thought to imply that relief in 1899-1900 was not liberal enough,—rather that it was over-liberal in 1896-97.

72 *Q.* Why was it less ?—1895-96 was a famine year in Bundelkhand; in 1893-94 and 1894-95 rust destroyed the whole of the wheat crops ; 1890-91 and 1891-92 were bad years. For more complete details see Mr. Hoare's Settlement Report for Lalitpur, p. 5.

73. *Q.* They had not been able to recover completely ?—No ; they had had only one good year (*i.e.*, 1897-98).

74. *Q.* That was sufficient to account for the distress not being quite so severe in 1899-1900 ?—Yes.

75. *Q.* What are the wells like ; are they most of them sunk through rock ?—They go down to the rock.

76. *Q.* Do they stop at the rock ?—They sometimes blast the rock, but they never go through the rock, I think; sometimes they come on to a spring, where the rock is fissured.

77. *Q.* How are the wells built ?—Generally with dry bricks.

78. *Q.* They don't use stone ?—In the south they use sandstone.

79. *Q.* Do they last an indefinite time ?—Fifty years.

80. *Q.* And then they fall in ?—Yes, if they are not looked after.

81. *Q.* If they were looked after, would they last an indefinite period ?—I think so.

82. *Q.* Have you seen any very old wells ?—There are a good many fairly old wells ; there is a properly built well in Lalitpur which is dated 1600.

83. *Q.* Is it very expensive ?—Yes.

84. *Q.* The main use of tanks is to feed wells. Is there any difficulty about getting wells made ; supposing you made tanks, would the people make wells ?—Yes, they might want *takavi.*

85. *Q.* To whom would it be given,—zamindars or tenants ?—Sometimes to the one, sometimes to the other.

86. *Q.* Are they small zamindars ?—The majority are small.

87. *Q.* Is there any difficulty in getting a joint agreement for *takavi* for a well or tank ?—There is sometimes difficulty, but you could square them if you talk to them.

88. *Q.* Would these tanks hold out in a year like 1896-97 ? —Yes, they had 35 inches against an average of 40.

89. *Q.* And in 1899-1900 ?—They got very dry that year.*

90. *Q.* But wells nevertheless held out ?—The *rabi* area went down 23 per cent. (answer not fully recorded).

91. *Q.* As regards this tank that cost Rs. 3,000, do you know what area is actually irrigated ?—It is more in the nature of a *bandhia.*

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92. *Q.* What is the area inside the tank that grows a good crop ?—60 to 70 acres.

93. *Q.* And the rental of that land ?—The land is now leased on *batai, i.e.,* the tenant and zamindar each takes half the produce ; in 1309 F. the zamindars' half converted into cash at current rates was recorded as Rs. 700 ; in 1308 between Rs. 500 and Rs. 600. At settlement the land was leased at Rs. 10 per acre.

94. *Q.* What is the dry rate ?—The land benefited by this tank was recorded in the 1860-68 settlement as *dumat* and the total rental of the area as Rs. 115.

95. *Q.* (*Mr. Rajaratna Mudaliar.*)—Does the whole of the rent go to the zamindar ?—Yes, Government has nothing but the land revenue.

96. *Q.* (*Mr. Muir-Mackenzie.*)—Do you think most of these tanks that you propose to make would have an area inside them that would be cultivable ?—Some would ; some would not ; it depends on the situation.

97. *Q.* Do you propose most of these tanks as relief works ?—Yes, but they would, of course want some masonry.

98. *Q.* Did you propose them as relief works in 1899-1900 ?—Yes.

99. *Q.* Were they adopted ?—To some extent, the famine besides was not so great as was expected ; there was some hesitation about putting the workers on tanks.

100. *Q.* Why was there hesitation ?—The projects were not quite ready.

101. *Q.* You don't think there would have been hesitation if the projects had been ready ?—I think the engineers preferred roads as being easier to manage ; these tanks are comparatively small works and more difficult to manage.

102. *Q.* With regard to the difficulties of management you don't consider them insuperable ?—No ; I am speaking, however, without much famine experience. I don't see why four to five tanks in neighbouring villages should not be made into one charge.

103. *Q.* You have spoken about the large rent a zamindar may expect if he makes a useful tank ; why is it that when without much difficulty and with exemption from assessment, the zamindars have not done more than they have ? —They have not the money, and they are not a particularly energetic lot ; some of the bigger zamindars have done something.

104. *Q.* What has been the results ?—I have no figures, but I will send them in.

105. *Q.* Was there much contraction of cultivation as the result of the famine of 1896-97 ?—Not very much ; there was a considerable change in the crops sown, but that was not so much due to famine as to rust.†

106. *Q.* There are a large number of these tanks still existing. Are they in very bad repair ?—Some are in excellent repair, but some have been let go.

107. *Q.* You recommend in your note that Rs. 50,000 per annum should be spent on construction and repair of tanks ; do you think any money should be spent on the repair of existing tanks ?—Yes, I think so.

108. *Q.* (*The President.*)—Do you think it is the duty of Government to keep them in repair where the people pay wet-rates ?—Yes.

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* Rainfall at Talbehat for period June to May—

1895-96—24·23 inches.
1896-97—37·88 „
1899-1900—19·68 „

Average for 23 years—36·28 inches.

Average rainfall at the four reporting stations in the sub-division for same periods :—

1895-96—29·35 inches.
1896-97—37·08 „
1899-1900—26·05 „

† The following figures illustrate this change :—

	KHARIF.				RABI.			
	Total area.	Small millets.	Juar.	Tili.	Total area.	Wheat (alone).	Wheat in combination.	Gram.
Average—	Acre.	Acre.	Acre.	Acre.	Acre.	Acre.	Acre.	Acre.
1298—1302 .	210,421	104,360	34,863	34,109	104,457	57,811	12,560	24,874
1306 . .	253,067	107,433	60,416	43,058	55,221	12,887	12,570	18,158

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109. *Q.* (*Mr. Rajaratna Mudaliar.*)—As regards the Parwa tank, were the lands in the water-spread uncultivated before the tank was repaired?—I believe they were cultivated like other dry lands.

110. *Q.* If a tank was repaired by Government at a large outlay, could the zamindar come in and levy a wet-rate?—Yes.

111. *Q.* Is that allowable under the law?—I don't know if it is allowable; in Lalitpur they hardly know what occupancy rights are.

112. *Q.* (*Mr. Muir-Mackenzie.*)—Would the landlord have any difficulty in getting another tenant for a good bit of wet land?—No, if he takes too much they leave him.

113. *Q.* (*Mr. Roberts.*)—Lalitpur is a particularly backward district; is it not?—Yes.

114. *Q.* The cultivated area compared with the culturable area is comparatively small?—Yes.

115. *Q.* And what is cultivated you explained can only be cultivated three years out of ten?—Yes, that is outlying land in the red soil tracts.

116. *Q.* A zamindar's rights are greatly subdivided in these parts?—Yes, in a great many villages, especially among the Lodis and Kurmis, you get some comparatively big Bundela landlords.

117. *Q.* A great many villages are *patidari*?—Yes.

118. *Q.* And they are cultivating zamindars?—Yes.

119. *Q.* In these *patidari* villages the best lands in the village are mostly cultivated by zamindars?—Yes.

120. *Q.* These Lalitpur people are very little given to civil and rent litigation?—Yes.

121. *Q.* They are particularly amenable to authority in these matters?—Yes.

122. *Q.* And the amount of civil and rent litigation relatively to the population that gives rise to litigation is smaller than in the district?—Certainly, there were, I think, only 19 ejection cases.

123. *Q.* That points to the fact that occupancy rights are not particularly valuable?—Yes.

124. *Q.* Landlords are not exerting themselves to prevent their acquisition, nor do tenants lay any great store by them?—No, occupancy rights, except as regards land within the *tareta* of the red soil villages, have almost reduced themselves to the right to a somewhat uncertain amount of certain kinds of land at customary rates.

125. *Q.* There is no great difference between occupancy rents and non-occupancy?—Practically none; Mr. Hall finds that, if anything, occupancy rights are a bit higher.

126. *Q.* In the case of improvements made, the question of the amount of benefit the tenant would be entitled to would be settled rather by custom than by recourse to the law courts?—Yes, certainly.

127. *Q.* The tenants would pay the same rates for wet land, however it had become wet?—Yes, they have certain customary rules to determine the amount for wet land.

128. *Q.* Neither party would claim the interposition of the law?—No.

129. *Q.* As regards these civil works that you call *bandhia* in your report?—I should have said village relief works.

130. *Q.* That means works not to be carried out by the Public Works Department?—Yes.

131. *Q.* Roads and big tanks employing 5,000 people are allotted to the Public Works Department and smaller works to the Civil Department?—Yes, but as regards the numbers in this programme, I would not like to lay any great stress on them.

132. *Q.* Would there be much difficulty in supervising these works?—I expect there would be.

133. *Q.* The principle of the division is that the works are supposed to be less open to supervision?—Yes.

134. *Q.* You mentioned one reason, why more tanks were not made is that the zamindars were too poor; that gives the hope that they would do more; you mentioned also that there are a great many existing tanks that have been allowed by the zamindars to burst and fall out of repair. What is the reason of this; can you say?—Want of money largely, but also want of energy and slackness, and also to the number of co-sharers which makes it difficult for them to arrange between themselves how to distribute the cost.

135. *Q.* If these tanks were taken up by Government on any extensive scale it would seem to follow that the repairs should be under Government supervision?—I think so certainly.

136. *Q.* They could not be left to zamindars?—I don't think so.

137. *Q.* (*The President.*)—Is there any point you would like to bring to the notice of the Commission?—I was talking to the *rais* of Gursarai. He wants a canal taken out of the Parichha reservoir on the east of the Betwa so as to take water into the Garotha pargana in which his estate (65 villages) lies. The difficulty here would be the hills near Parwa. I was also talking to a considerable landowner of Chirgaon who asked about the possibility of constructing a short canal from Parichha at a higher level than the existing Betwa canal to irrigate land around Chirgaon (*i.e.*, nearer the head-works of the canal).

138. *Q.* Would the *rais* be willing to take water on *mar* land?—He said he would, but it is mostly wanted for *kabar*.

सत्यमेव जयते

WITNESS No. 45.—DEWAN PARTAB SINGH, Malehta, District Hamirpur.

Dewan Partab Singh.

5th Dec. 02.

(*To the President.*)—I own 30 or 40 villages scattered about. There is no irrigation in his village except around a few wells. There is some irrigation from Bela Tal. In the famine Government gave help to my tenants. The proposed Dassan Canal would do great good; all would welcome it. There is a good deal of *mar*, but *kans* has spread over it, therefore they would take water, as the *kans* has made the soil drier. They will grow *pisia* wheat instead of *katia*, because there is fear of rust in *katia* if crops are irrigated. They will irrigate rice. They grow plenty of rice in my villages in Pawa; they do not grow it in *mar*, but grow it in *kabar*. There are some *bandhs*; little *bandhs* are 3 feet high, specially in rice fields. There is excellent *mar* land, in which there is no need for *bandhs*. They will make *bandhs* now on account of *kans*. *Bandhs* are no good in *mar* land, except to kill *kans*.

WITNESS No. 46.—MŮNSHI BEHARI LAL, Zilladar.

Munshi Behari Lal.

5th Dec. 02.

(*To the President.*)—Why is rice not irrigated on the Betwa Canal? The people irrigate rice on Barwa Sagar, but on low lands. On the Betwa Canal the soil is not suitable; *parwa* which is suitable is situated too high on the Betwa Canal. The cultivators are lazy and prefer *juar* and *bajra* which they find gives less trouble. Rice would be more profitable. I tried to get it introduced but failed.

WITNESS No. 47.—MR. R. P. ATKINSON, Superintending Engineer, P. W. D.

(*Replies to printed questions.*)

A.—GENERAL.

Mr. R. P. Atkinson.

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1. The answers below apply to the country irrigated by the Betwa Canal. Nine-tenths of the country irrigated lies between the Betwa and Pahuj rivers south and north, the Jumna on the east, and a straight line drawn through Kunch to Orai and from Orai to the south (see the map herewith).

I have been in charge of the Betwa Canal Division for 21 months since October 1899, and in charge of the Circle in which the Betwa Canal lies for seven months.

Table I.—*Average Rainfall each month for Jalaun for last ten years and for last five years.*

Years.	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.
1891-92 . . .	...	·80	·30	11·50	13·80	11·90	...	...	...	·80	·50	...
1892-93 . . .	...	1·30	2·90	9·90	11·90	1·90	...	...	...	1·10	1·10	·40
1893-94 . . .	·10	...	3·90	8·20	6·20	9·80	1·50	·30	·50	1·00	·20	...
1894-95 . . .	...	·20	7·10	13·80	15·70	4·50	3·70	1·50	...	1·60	...	·20
1895-96 . . .	...	·10	9·50	5·00	15·80	1·60	...	...	·30	...	...	...
1896-97 . . .	...	...	6·40	3·50	4·90	...	...	·40	·30	1·50	...	...
1897-98 . . .	...	...	5·80	15·20	13·10	·40	·90	...	...	...	3·50	...
1898-99 . . .	...	...	4·60	9·40	13·10	7·40	·10	...	·30	...	...	...
1899-1900 . . .	...	·30	7·60	8·80	2·40	5·50	...	...	...	·90	...	...
1900-01 . . .	...	·80	...	5·55	8·65	2·65	...	...	·95	1·50	·75	...
Total for last 10 years .	·10	3·20	47·30	90·85	105·55	45·65	6·20	2·20	2·35	8·40	6·05	·60
Average ditto .	·01	·32	4·73	9·08	10·55	4·56	·62	·22	·23	·84	·60	·6
Total for last 5 years .	...	·60	24·20	42·45	42·15	15·95	1·00	·40	1·55	3·90	4·25	...
Average ditto .	...	·12	4·84	8·49	8·43	3·19	·20	·08	·31	·78	·85	...

2. The average rainfall for the last ten years in each month at Jalaun, which is central, is shown in the above table.

The average for the last five years at the same place is also shown. The figures for Jalaun are representative for the whole tract.

The important rainfalls are—

(1) *June and July.*—To enable the land to be ploughed and sown for the *kharif* crops: the earlier in June that rain falls, not less than two inches at a time, the better.

(2) *August and September.*—To nourish and, towards the end of September, mature the crops sown in the two preceding months.

Good rain in the second-half of September or early in October allows the black soil to be prepared and sown for *rabi*.

Failure of rain after the middle of September involves failure to get the autumn crops matured and the black soil *rabi* crops sown, and is a most serious thing. Rain at this time is more valuable than at any other, assuming, of course, that the season so far has been normal.

(3) *October and November.*—Rain in these months allows land to be prepared for, and *rabi* crops to be sown.

(4) *December to March.*—Rain is needed in December for *rabi* crops properly germinated. At any time during the months December to March it is beneficial, and is seldom in excess except on black soil, on which crops are specially liable to be damaged by rust. The damage done seems, however, generally attributable to the absence of sunshine rather than to the excess of moisture.

If the cloudy weather preceding rain is of short duration and the sky clear except during storm periods, the (*rabi*) crops will stand a lot of moisture.

3. (1), (2) and (3).—Yes. The whole tract has suffered severely whenever there has been a famine.

The results have been emigration of the population and mortality amongst the cattle, and the district has not yet recovered. Men, cattle and manure are deficient.

(4) There is a good deal of black soil. It is of two kinds called *mar* and *kabar*. The latter is intermediate between *mar* and the common yellow soil *parwa*, *kabar* takes irrigation fairly freely and a good deal of *mar* is also irrigated. The area of irrigated *mar* is on the whole increasing, as shown by the figures below.

The impetus was given by the famine of 1896-97, and the figures for that year are, of course, high.

Table II.—*Area irrigated by soil in each rabi.*

Rabi.	Mar.	Kabar.	Other soils.	Total.
1890-91 . .	1,082	9,746	19,336	30,164
1891-92 . .	1,348	6,074	19,790	27,212
1892-93 . .	1,097	4,129	14,266	19,492
1893-94 . .	75	2,256	11,654	13,985
1894-95 . .	107	504	3,063	3,674
1895-96 . .	1,319	4,089	25,572	30,980
1896-97 . .	18,860	20,273	23,113	62,246
1897-98 . .	9,045	12,800	26,343	48,188
1898-99 . .	5,315	9,853	21,981	37,149
1899-1900 . .	7,420	9,995	16,053	33,468
1900-01 . .	6,710	10,227	16,313	33,250

In brief, none of the soils on the Betwa Canal is unsuited to irrigation, but *mar* does not often, in comparison with other kinds, require it.

(5) I see daily, I may say, fresh land broken up and sown, bits out of large tracts which are, and have been, for years, lying uncultivated. This extension of cultivation I attribute almost entirely to the influence of the Betwa Canal, which was the saving of the tract of country now under consideration in 1896-97 and again in 1899-1900. In the latter year, however, *the area that was irrigated was not more than one-third of that requiring irrigation*, as the quantity of water which it was possible to store in the river Betwa was exhausted, and the river itself ran dry in October.

Much more storage is needed, and a preliminary scheme for this purpose was submitted by me lately when I was in charge as Superintending Engineer, 3rd Circle, Irrigation Works, North-Western Provinces and Oudh.

The cost liberally estimated is 15 to 16 lakhs; the result proposed is complete protection in a year of drought to 50 per cent. of the normal *rabi* area grown in the tract commanded by the Betwa Canal. In ordinary years a large extension of *kharif* irrigation would result in course of time. At present the rate of extension of *rabi* cultivation into the

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waste land tracts is low, but with a more ample supply of water it will increase steadily. With a more assured supply for *kharif* irrigation it is likely, moreover, that a better class of cultivators and improved cultivation will be gradually introduced.

(6), (7) and (8)—*Nil.*

(9) The concluding words above 3 (5) were written with reference to the carelessness I find prevalent in the cultivation and more especially the irrigation of this country.

Fields are frequently ploughed up anyhow, leaving shapeless islands of unbroken ground covered with grass in the middle of crops. Along distributaries, where borrow-pits were dug to supply the earth for the banks, I have seen hardly any attempts made to put up a small *mend* or *daula* along the edge of the borrow-pit; the result is of course that, when irrigated, the crops sown in the borrow-pit are *literally* drowned, as the irrigation water naturally runs most easily into the low ground; one man's labour for a very short time would have obviated this.

I think this carelessness is a very decided obstacle to the extension of irrigation. At the same time I think it must be dealt with tenderly for some time to come at any rate. These people have as a result of repeated calamities got into such a habit of accepting everything as it comes that they will not be easily roused out of their apathetic ways. I find, however, signs that the apathy is beginning to be dissipated in the letters and complaints regarding irrigation, difficulties which are received through the post, as well as in the course of my inspections.

4 *Nil.*

5. *Nil.*

6. I have not found or heard that the irrigated tracts attract the cultivators from the unirrigated villages in the Betwa Canal country. I remember very well, however, that in the summer of 1896, a famine year, there was a great emigration into the lands along the tail of the Bhognipur Branch, Lower Ganges Canal, in the Cawnpore district, on the left bank of the Jumna just opposite to the Jalaun district. Some of the emigrants came from Jalaun, but many of them from Gwalior and beyond, I believe. They left Jalaun because the protection afforded by the Betwa Canal was insufficient, and many of them, too, had relations in the Bhognipur country, who, of course, told them what a good opening there was for them there: lots of land and plenty of water.

Yes. I am continually receiving applications for new outlets or new distributaries or extensions of present channels. Every defect of rainfall leads to more and more applications being made.

B.—Canals of Continuous Flow.

Note.—The Betwa Canal has been taken under the head B because it is intended to be a canal of continuous flow.

At present, however, the store of water is absolutely insufficient; for instance by March 1900 the store was exhausted and there was none available for *kharif*. It is likely that the same thing will occur in March of the current year 1902.

The amount that can be stored now is *one-third more* than it was in 1899-1900, owing to the recent addition of shutters on the Betwa weir; but this, although unquestionably a most valuable help, is quite inadequate and more storage is urgently needed [see above, answer to question 3 (5)].

7. (1) At present early *kharif* irrigation on the Betwa Canal is very uncertain owing to the uncertainty of a sufficient supply.

The early *kharif* is that crop grown for 2 to 3 months in absolute dependence on canal water. It is a pure net addition to the value of the produce of land in this tract, since without canal water it simply is not grown. It is always necessary to issue notice to cultivators on the Betwa Canal to notify whether there is water for *kharif* or not.

(2) The question of substitution of more for less valuable crops does not affect the Betwa Canal very much.

As stated above, *if there is water* early *kharif* is grown, if there is no water it is not. It does not seem that early *kharif* displaces any other crop, for the usual area of late *kharif* is sown in any case, and any early *kharif* is additional to that usual area.

It is not likely that the area of early *kharif* will materially affect the normal area of late *kharif* for many years to come. There is so much uncultivated ground due to the pressure of late famines that there is ample room for expansion.

The early *kharif* will no doubt occupy the better lands and the expansion take place in the cultivation of late *kharif* in the at present uncultivated lands.

As regards *rabi*, Table III below shows that there is no marked tendency to increase in the area of superior crops.

In 1896-97 and 1899-1900, the two driest seasons—and they were both very dry indeed—it is remarkable how much the area of *superior* crops diminished.

Table III.—*Area of Class II crops for each Rabi—Tobacco, Poppy and Spices, Vegetables, Gardens and Orchards, Waternuts.*

Year.	Area.
1890-91	4,381
1891-92	2,005
1892-93	1,955
1893-94	2,395
1894-95	1,198
1895-96	1,226
1896-97	807
1897-98	1,749
1898-99	2,406
1899-1900	461
1900-01	1,735

(3) (*a*) In a year of ample rainfall falling at the right time irrigation is not resorted to. It is, however, seldom that the rainfall is both ample *and timely* in the same year, and there is generally some irrigation done.

On the one hand, in the cold weather of 1900-01 the rainfall after 15th December was ample,—indeed almost excessive, but 33,000 acres of *rabi* were irrigated because there was no rain during the two-and-a-half months preceding 15th December, and water was needed for sowings.

On the other hand in the present cold weather, 1901-02, there was an inch of rain over the Kathaund Branch in the middle of October, and the area irrigated was far behind that of the previous year until water was needed for the crops sown and germinated by means of the moisture due to the October rain. Had there been a shower early in December the irrigated area would have been insignificant. In the same season there was no rain in October over the Hamirpur Branch, and the demand for canal water was early and hot.

On the whole, when the rainfall is *ample and timely* canal irrigation does not increase the yield at all.

(*b*) In a year of scanty rainfall, assuming, moreover, that the rain is *not* timely, the yield is increased by irrigation.

The extent of the increase depends entirely on the *untimeliness* of the rainfall—for suppose a case where there has been just enough rain to allow a normal area to be sown and to exist without absolutely withering until the second half of September, a downpour of three inches then would not raise the rainfall above the classification "scanty," but would probably produce a 16-anna crop as far as grain was concerned, though the straw outturn would probably be not more than ten annas.

(*a*) (*b*) In a year of *normal* rainfall the increase in outturn due to irrigation is given below for wheat and gram which are the main cold-weather crops:—

Crops.	Produce per acre in maunds.		Income due to canal irrigation.	
	Unirrigated.	Irrigated.		
Wheat	9	12	3	33 per cent.
Gram	8	11	3	37·5 per cent.
		Mean say		35 per cent.

The value of the crops fluctuates very considerably. The tables below under paragraph 8 give the area and estimated value and values per acre of the *kharif* and *rabi* crops separately for a term of years, and in the table for *rabi* a column has been added showing 35 per cent. (as above) of the estimated value of the crops, which may be taken as the proportion of the total value due to canal irrigation in normal years.

(*c*) In a year of drought if the drought is complete, *i.e.*, no rain in June and July, the Betwa Canal would generally be of no use at all, as there would be no water. In the case of a drought similar to that of 1896 falling in August and September the increase in outturn due to irrigation would probably be from 100 to 200 per cent., *i.e.*, crops which would without irrigation have given 5 to 8 annas outturn, would when irrigated give 16 annas, the actual figures for area irrigated and value of crops, 1896, are shown in the table for *kharif* below paragraph 8.

As regards *rabi* in a year of drought, *i.e.*, of no rain at all in the cold weather months, the increase in outturn due to irrigation is much the same, 100 to 200 per cent. in yellow soil, and about 50 per cent. in *kabar*.

Mar sown under autumn rain moisture hardly needs, and will very seldom take, canal water even if there is no cold weather rain. But at the same time if the autumn rain is deficient, canal water is taken in *mar* soil in order to plough and sow *rabi which otherwise could not be sown at all.* In this case the increase in value due to the irrigation is "infinity." This is one of the most important features of the Betwa Canal system, and, necessitates the development of the system, so that it may be able to distribute a very large volume of water in a very short time, 3 to 4 weeks, for *rabi* ploughings in *mar* soil in a drought year. Nearly 19,000 acres of *mar* and 39,000 acres of *mar* and *kabar* together were irrigated in the *rabi* of 1896-97, when the conditions were as above described. The canal ought to be able to irrigate much more than this. This point has been developed in the project for remodelling the Kathaund Branch submitted to Government by me in October 1901 when officiating as Superintending Engineer, 3rd Circle, Irrigation Works.

8. (1) The table IV (attached to this paragraph below) of 1890 to 1899 shows that the average value per acre of early *kharif* is about Rs. 22-8 (the famine year 1896 is omitted in this calculation).

The whole of this Rs. 22-8 is increase in the annual value of the produce of the land as shown under 7 (1) and (2).

The table V shows that the estimated increase in value of *rabi* crops per acre due to canal irrigation is Rs. 8-12 for the same term of years—including 1896-97.

(2) As regards a drought year, it may be said that the increase in value per acre for *kharif* crops due to canal irrigation is at least Rs. 16-8 per acre or two-thirds the total value in normal years. This is probably a low estimate because of the higher value of produce in a year of drought.

The estimate for *rabi* is more complex.

(*a*) *Mar* soil. The whole outturn is due to canal irrigation and amounts to Rs. 25 to 30 per acre.

In other soils there is a possibility of ploughing and sowing some ground without canal water and with some prospect of outturn, particularly if rain falls in the cold weather. In this case the increase due to irrigation is about one-and-a-half that of a normal year, or Rs. 13 per acre. Of course if no rain falls in the cold weather, or if it falls at the wrong time, the increase in value of outturn per acre due to irrigation will rise to as much as Rs. 16-8 per acre, or two-thirds or more of the whole value.

It is difficult to fix these values except approximately as there are so many variables, *e.g.*, degree of drought, extent of degree of drought, rise in value of produce due to drought, etc., and it is believed that the increases credited to canal irrigation are in all cases moderate and below the actual value.

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TABLE IV.—*Area and value of irrigated* kharif *each year beginning with 1890.*

Year.	*Kharif* area.	Value of crops.	
	Acres.	Rs.	
1890 . .	3,789	1,00,409	
1891 . .	3,394	87,438	
1892 . .	2,930	86,410	
1893 . .	4,819	1,15,002	
1894 . .	4,367	80,719	
1895 . .	4,312	96,798	
1896 . .	25,660	6,34,026	
1897 . .	807	14,383	
1898 . .	2,411	22,603	
1899 . .	3,154	73,551	
Total omitting 1896 . .	29,983	6,77,313	Value per acre = Rs. 22·59
Total including 1896 . .	55,643	13,11,339	Ditto = 23·56
1896 alone .	25,660	6,34,026	Ditto = 24·70

NOTE.—The figures of value of crops for 1900-1901 are not yet published.

TABLE V.—*Area and value of irrigated* rabi *each year beginning with 1890-91.*

Year.	*Rabi* area.	Value of crops.	35 per cent. of value (due to irrigation).
	Acres.	Rs.	Rs.
1890-91 . . .	30,164	11,03,888	3,86,361
1891-92 . . .	27,212	6,37,020	2,22,957
1892-93 . . .	19,492	7,48,722	2,62,052
1893-94 . . .	13,985	3,44,956	1,20,735
1894-95 . . .	3,674	1,12,982	39,544
1895-96 . . .	30,980	5,93,388	2,07,686
1896-97 . . .	61,646	16,76,780	5,86,873
1897-98 . . .	48,187	10,38,530	3,63,485
1898-99 . . .	37,149	7,86,768	2,75,369
1899-1900 . .	33,468	6,30,025	2,22,509
Total .	305,957	76,73,059	26,85,571

Total value per acre . . . . = Rs. 25·08

35 per cent. of the same . . . = 8·78

TABLE VI.—*Annual water-rate for last ten years from* rabi, *1890-91, to* kharif, *1901.*

Year.	WATER-RATE.			AREA IRRIGATED.			Water-rate per acre for each year.	Water-rate per acre for total of ten years from *rabi*, 1890-91, to *kharif* 1900-1901.
	Kharif.	*Rabi.*	Total.	*Kharif.*	*Rabi.*	Total.		
1890-91 . . .	15,424	84,911	1,00,335	3,789	30,164	33,953	2·95	$\frac{8,73,723}{9,93,434} = 2\cdot22$
1891-92 . . .	12,640	69,427	82,067	3,394	27,212	30,606	2·68	
1892-93 . . .	12,069	50,395	62,464	2,930	19,492	22,422	2·78	
1893-94 . . .	18,782	40,552	59,334	4,819	13,985	18,804	3·20	
1894-95 . . .	15,385	11,306	26,691	4,367	3,674	8,041	3·31	
1895-96 . . .	16,554	74,023	90,577	4,312	30,980	35,292	2·56	
1896-97 . . .	55,503	85,123	1,40,626	25,660	61,646	87,306	1·61	
1897-98 . . .	1,214	1,01,688	1,02,902	807	48,187	48,994	2·10	
1898-99 . . .	6,882	85,033	91,915	2,411	37,149	39,560	2·32	
1899-1900 . .	7,842	52,477	60,319	3,154	33,468	36,622	1·65	
1900-1901 . .	20	598	65,618	10	33,250	33,260	1·97	
1901-1902 . .	6,304	...	...	2,353	...	...	...	

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9. (1) The owner of the canal in this case is the Government. The average annual water-rate paid by the cultivator to Government for a term of years is given in Table VI above and amounts to Rs. 2·22.

The great variations are, of course, due to variations in the class of crops irrigated. Thus the very low water-rate for 1896-97 is due to the very large area of black soil irrigated, which is rated very low.

(2) Nothing is paid by the cultivator to the owner of the land.

(3) No owner's rate is levied on the Betwa Canal.

10. The landlords generally cultivate their own land; they and their tenants combine to make the necessary water channels for conveying water on to the land and to prepare the latter. As a rule, there is no cash expenditure except when culverts have to be provided, and then landlords and tenants pay in proportion to the area irrigated by each.

11. No cases of damage due to over-watering or saturation have come under my notice.

However, a considerable trouble in the Betwa Canal is the cracky nature of black soil. This leads at times and in places to much percolation near distributary and canal channels, and compensation has to be paid.

The damage, however, is only superficial. There is no saturation, because the soaking is from above and not from below, and it is temporary. As soon as the channel is closed the water disappears.

None of the other evils mentioned in this question are known to me to have occurred in the Betwa Canal country.

Below I attach a brief summary of my replies to the questions.

A.—GENERAL.

1. Map attached, 2 years in executive charge.
2. Table attached.
3. (1) Yes.
   (2) Yes.
   (3) Yes.
   (4) To some extent.
   (5) Yes.
   (6), (7) and (8) Blank.
   (9) Yes, carelessness and apathy.

4 and 5. Blank.

6. Not appreciably.

There is a strong desire to extend irrigation.

B.—CONTINUOUS FLOW CANALS.

7. (1) Early *kharif* is entirely due to and dependent on canal irrigation.

(2) There is little displacement of inferior crops. The uncultivated area available is very large.

(3) (*a*) If the rainfall is also timely, *nil*. If not about 35 per cent.

(3) (*b*) From 35 per cent. upwards according to h degree of drought up to

(*c*) 75 per cent., 100 per cent., 200 per cent., and infinity according to circumstances.

8. For *kharif*.

(1) Average normal, Rs. 22-8-0 per acre early *kharif*.

(2) Drought year. The above *plus* at least Rs. 16-8-0 per acre of late *kharif* irrigated.

For *rabi*.

(1) Average normal Rs. 8-12-0 per acre.

(2) Drought year Rs. 16-8-0.

9. (1) Rs. 2·22.
   (2) *Nil.*
   (3) *Nil.*

10. *Nil.* Landlord and tenant supply necessary *labour* personally.

11. *Nil.* Percolation through black soil banks is the only evil, and it is superficial and temporary.

सत्यमेव जयते

Note, dated 29th September 1902, on possible extensions of irrigation from existing canals in the 3rd Circle, Irrigation Works, into Minor Doábs, which are as yet unirrigated by them.

The canals in this circle are very much scattered as shown by the (1"=16 miles scale) map herewith.

There are five divisions:—

(1) the Betwa Canal Division;
(2) the Rohilkhand Canals Division;
(3) the Eastern Jumna Canal, Upper Division;
(4) „ „ „ Lower Division;
(5) the Agra Canal Division.

2. The Betwa Canal runs from south to north, and irrigates the country lying north of Jhansi, south of the Jumna, and west of the Betwa river.

3. The Rohilkhand Canals consist of a large number of small canals derived from rivers, and irrigating various tracts in the Bareilly, Pilibhit, Tarai, and Bijnor districts.

4. The Eastern Jumna Canal includes the Dun Canals, which are five small channels derived from rivers under the hills in Dehra Dun and irrigating in that valley. The Eastern Jumna Canal itself is derived from the left bank of the river Jumna, where it leaves the Siwalik Hills at the south-west corner of Dehra Dun. It irrigates a strip of country lying between the rivers Jumna in the west and Hindan in the east and extending from the Himalayas as far south as Delhi

There are two divisional charges—the Upper Division, Eastern Jumna Canal, comprising the Dun Canals and the Eastern Jumna Canal from the head to mile 56, and the Lower Division, which includes the rest of the Eastern Jumna Canal.

5. The Agra Canal is also derived from the Jumna river, but does not depend on it alone. The water of the Hindan is intercepted by the Hindan dam opposite Delhi, and turned into the Jumna above the head of the Agra Canal.

The Agra Canal supply during the hot weather, moreover, is very largely obtained from the Ganges Canal, which sends water down the Jani escape opposite Meerut into the Hindan river, down which and the connected works it passes on to the head of the canal.

6. *The Betwa Canal.*—On this canal there is room for much development of irrigation, as shown in detail on the 1"=1 mile map sent by the Executive Engineer. But here, as elsewhere, the great hindrance to the development and extension of irrigation is the want of water.

There are, in fact, two obstacles in the way of rapid development of irrigation in the Betwa Canal country, *viz.*,—

(1) the prejudice against irrigating pure black soil (*mar*), which, however, is gradually giving way as the advantages of irrigation on *mar* soil are more and more shown by the increase in irrigated area of *mar* due to dry years; and

(2) the want of water. In the excessively dry *rabi* of 1899-1900 the canal with difficulty irrigated, roughly, 33,000 acres, and then the supply was entirely exhausted and no *kharif* irrigation could be done.

Again, in the next *rabi* (1900-1901), which was so wet after the middle of December as to stop irrigation entirely, the canal irrigated, roughly, 34,000 acres, and the reservoir was full at the end of it. Some *kharif* irrigation followed, but confidence in the canal supply for *kharif* irrigation had been shaken by the failures of the previous year and of others, and the area was not as large as it ought to have been, and a quantity of water was still left in the reservoir when the rains broke.

In the meantime the weir had been raised and shutters added on the crest, and this work increased by nearly 40 per cent. the capacity of the reservoir. Consequently on this increased capacity an area of about 45,000 acres was irrigated in *rabi*, 1901-1902, but the reservoir was so nearly exhausted that it was again impossible to irrigate any *kharif*. A larger area of *rabi* might have been irrigated, but the small carrying capacity of the distributaries and parts of the branch canals prevented the water being passed down in large enough volumes, and thus there was a good deal of waste. The latter fault is being attended to, and channels are being remodelled as fast as possible.

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But the want of more water is acutely felt whenever a pinch comes. Estimates have been called for for more reservoirs; one estimate is ready, and two others will be ready very shortly, as soon as the weather allows of the survey operations, in order to verify some old surveys and ascertain a few additional facts.

7. *The Rohilkhand and Bijnor Canals.*—The Executive Engineer, Mr. F. E. Ball, reports that there are practically no extensions possible, and, if there were, there is a formidable obstacle in the utter deficiency of supply in the hot weather.

The rivers are derived from the Tarai swamps, and there is so far no practical way known of adding to the natural storage.

8. *The Dun Canals.*—There is room for some extensions here, but the insufficiency of supply in the hot weather in all streams but the Jumna makes the schemes impossible. It will, no doubt, be found possible eventually to extend irrigation on the Kata Pathar Canal, which takes out of the Jumna river in the Western Dun.

The Executive Engineer has not reported in detail, and I write from recollection of the country.

9. *The Eastern Jumna Canal.*—The Executive Engineer, Upper Division, states that he is not aware of any extensions possible. He is new to the division as I am to the circle, and I cannot say anything definite about the Upper Division. The Executive Engineer, Lower Division, sends a map showing large tracts not at present irrigated in which it is desirable to extend irrigation.

10. With reference to the Eastern Jumna Canal generally, it is necessary to point out that the Western Jumna Canal in the Punjab gets the lion's share of the water of the river Jumna, taking twice as much as the Eastern Jumna Canal. This, judging by the areas irrigated in the *rabi*, 1899-1900, is not a correct division. The figures stand as noted below, and the conditions of demand on the two sides of the river were as nearly similar as it is ever likely they can be. A copy of the note from which the figures are taken has been already forwarded, it is believed, to the Irrigation Commission (Note No. C.-201, dated 21st March 1902, by H. Marsh, Esq., C.I.E., Superintending Engineer, 3rd Circle, Irrigation Works, United Provinces of Agra and Oudh):—

	Acres.		
	Rabi.	Sugar-cane.	Total.
Punjab.			
Western Jumna Canal	314,705	73,167	387,872
United Provinces.			
Eastern Jumna Canal.	167,345	63,362	230,707

The proportions of the areas are –

$$\frac{\text{Western Jumna Canal}\ \ 387{,}872}{\text{Eastern Jumna Canal}\ \ 230{,}707} = \frac{100}{62.}$$

It would seem therefore that, judged by these areas alone, the Eastern Jumna Canal should have a considerably larger share than it gets at present, and it is rather hopeless to expect that development in the Lower Division (and also no doubt in the Upper Division) which is desirable, and for which there is scope, unless a larger share of water is given.

11. *The Agra Canal.*—The country of this canal is peculiar. As reported by the Executive Engineer, there are no minor doabs into which irrigation can be extended.

There is, however, a great deal of country into which extensions are possible and desirable.

The drainage is very obscure and in many parts nonexistent, and this accounts for the absence of doabs.

Here, again, the difficulty is the short supply of water This year, moreover,—and the same conditions are liable to recur at any time,—it was at various times necessary to deprive the canal of its supply, in order to meet the requirements (1) for the drinking water-supply of the Agra city, cantonments, and civil station, and (2) for flushing the river both at Muttra and at Agra in order to avoid risk of epidemic disease.

12. It may be stated, in conclusion, that extensions are possible on nearly all canals and considerable extensions on many of them, but all are at present out of the question because of the scanty supply of water.

Note, dated 2nd October 1902, on the improvements effected of recent years in the duty of water, etc.

The table attached showing the area irrigated *per cusec of discharge utilized* (*columns 11 and 12*) on the four Main Canal Systems, in certain years, since 1889, selected as being years of high to very high demand, shows on the whole a marked progressive improvement in the "duty" of the water utilized.

There is also a general improvement to be observed in the proportion $\frac{\text{average discharge utilized}}{\text{average discharge at head}}$ (columns 9 and 10).

(There seems to be a mistake in the figures for Lower Ganges Canal, 1900.)

2. The figures have been taken from the Irrigation Revenue Reports of the United Provinces of Agra and Oudh

In the dry years before 1889 the Revenue Report figures under comparison were taken out in a way differing from that now followed, and it is therefore not easy to make proper comparisons between the two methods.

3. It is, moreover, only of quite recent years that the influences of redistribution and of remodelling have begun to be felt. These two are without doubt the most potent influences at work, at present, to produce economy of water in irrigation; and as the improvement of the different canal systems on these lines is gradually completed so will the improvement in "duty" become greater.

Canal.	Year.	Acres irrigated.		Average discharge at head.		Average discharge utilized.		Average discharge utilized. / Average discharge at head.		Acres irrigated per cusec of average discharge utilized.	
		Kharif.	Rabi.	Kharif.	Rabi.	Kharif.	Rabi.	Kharif.	Rabi.	Kharif.	Rabi.
1	2	3	4	5	6	7	8	9	10	11	12
Upper Ganges	1890	284,653	522,921	3,412	3,885	3,157	3,670	92·5	94·5	90	143
	1897	442,210	641,024	4,883	4,393	4,479	4,115	92·7	93·7	99	155
	1900	496,793	764,628	5,068	4,561	4,723	4,507	93·2	98·8	105	170
	1902	...	...	...	...	...	...	...	...	...	...
Lower Ganges	1890	138,771	361,123	2,389	3,637	1,865	2,829	78·1	77·7	74	128
	1897	382,875	659,787	4,738	4,083	3,453	3,578	72·9	87·6	111	184
	1900	230,497	515,599	3,822	3,116	2,423	2,596	63·4	83·3	95	198
	1902	...	...	...	...	...	...	...	...	...	...
Agra	1890	63,703	114,551	1,186	1,207	865	1,021	72·9	84·6	74	112
	1897	111,964	196,040	999	1,214	862	1,137	86·3	93	130	172
	1900	104,244	160,183	971	935	910	931	93·7	99	114	181
	1902	110,694	150,033	1,192	1,219	1,080	1,201	90·6	98·5	102	135
Eastern Jumna	1890	99,370	144,447	1,051	987	1,006	942	95·7	95·5	99	153
	1897	145,925	178,775	1,417	1,161	1,348	1,156	95·1	99·6	108	155
	1900	154,123	167,345	1,478	1,016	1,371	1,016	96·0	100·0	112	227
	1902	157,346	191,706	1,388	1,278	1,310	1,252	94·4	98·0	120	196

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4. The improvement in irrigation efficiency, or, as it used to be called "duty," rendered possible by the measures of remodelling and redistribution already carried out, and still being effected, is obtained by (1) removing redundant outlets after careful examination, and (2) enlarging the capacity of each distributary so much that it will carry water enough to satisfy simultaneously the demands made by all the outlets in it, from head to tail. The result shown by experience on remodelled channels, and put briefly in round numbers, is that a remodelled distributary, discharging 133 cusecs through its head and running in alternate weeks, will irrigate the same area as it did before being remodelled, during four weeks of continuous running and discharging 100 cusecs at the head.

5. It has long been known that the greatest loss of water occurs in the water-courses.

The improvement of the channels under Government control will be practically completed in a few years, and it stands to reason that the next improvement must be made in the water-courses.

6. (1) The estimated loss in Main Canal of supply entering head of canal has not been reduced. It is variously estimated at from 6·3 to 20 per cent.

(2) The loss in distributaries has been much reduced both by the alternate running rendered possible by remodelling and by regrading the channels on a slope flat enough to allow of a thin deposit of silt on bed and berms which staunches them, and render them practically water-tight in everything but very sandy soil.

The loss in distributaries was formerly estimated at from 23·4 per cent. by Mr. R. A. Cordner, Superintending Engineer, Ganges Canal, down to 6 per cent. by Mr. (now Sir T. Higham, Superintending Engineer, Sirhind Circle.

The former figure seems much more likely to be correct considering that the wetted perimeter required to carry a given volume is much greater in a number of distributaries than in a single large canal.

On the other hand, distributary channels are generally more water-tight than canals since the velocity and scouring action are less.

Probably the actual loss in distributaries, before remodelling was undertaken, was 15 to 20 per cent. of the supply entering the canal.

Now it may be estimated at 10 to 13 per cent. of that volume.

(3) The loss in water-courses has not yet been materially reduced and is still estimated at about 46 per cent. of volume entering canal.

7. No recent data are available regarding experiments in puddling water-courses or rendering them water-tight by other means.

The only instance bearing on the subject which has come to my notice is one mentioned by Mr. A. C. Evans, Executive Engineer, Aligarh Division, Ganges Canal, as occurring in 1897-98.

The railway tank at Aligarh was enlarged by digging out the bed and flattening the slopes. The result was that the quantity of water which used to last a month before the clearance lasted for only one week after it. Under Mr. Evans' advice the tank was then lined with slop moulded bricks made from tank clay and was found to have been made practically water-tight.

I may add that I quite recently inspected a couple of small distributary channels in Dehra Dun. The natural soil is of alternate beds of clay and of boulder formation. The clay where exposed was full of holes made by crabs which appeared to penetrate through to the boulders. Formerly when I was in charge of the Dun Canals in 1886—1889 these two channels, in common with all the *kachcha* channels in Dehra Dun, ran with very rapid slopes and high velocities which perpetually caused scour leading to great loss by percolation.

In the course of the last two or three years the same principles of remodelling by adopting flat slopes and low velocities have been applied here (by Mr. H. Marsh, C.I.E.) as in the flatter country south of the Siwalik Hills. The consequence is a deposit of silt which appears to have completely staunched the very porous bed and sides of the channels.

The experiment is too young yet for any unanswerable arguments to be derived from it, but the results obtained as regards area irrigated point to a very marked improvement in economy.

1. *Q.* (*The President.*)—You were formerly Executive Engineer on the Betwa Canal?—Yes.

2. *Q.* Had you any experience of Bundelkhand before that?—No.

3. *Q.* Were you here in the famine?—No. I know nothing about the famine in Bundelkhand.

4. *Q.* What do you think the best course for extending irrigation in Bundelkhand?—Developing the present system and building storage reservoirs.

5. *Q.* The first depends on the second?—To a great extent. But we can do more irrigation with what we have got, *i.e.*, by developing the system.

6. *Q.* To a material extent?—Yes, especially in a year of drought, because at the end of the rains at the beginning of the cold weather there is always a large amount of water in the Betwa. As soon as our distributaries are made sufficiently large we can utilize a great deal of the surplus water.

7. *Q.* You have no doubt about that?—None.

8. *Q.* The figures are not very encouraging?—No; the canal has been badly handicapped for want of water.

9. *Q.* Extension depends on whether there is any more water?—I think so certainly, particularly as regards the *kharif*; that is the early *kharif*. We could double the *kharif* if we could get the water stored. All through last cold weather whilst I was marching about the canal I had to say that I could not promise water for early *kharif* sowings, as the cold weather had not developed itself; I did not know whether it was going to be a dry or a wet year. It turned out to be dry and we used all the water for the *rabi*.

10. *Q.* That is the water stored?—Yes. We include also the water which is running down the river all the time.

11. *Q.* In the hot weather what does that amount to?—Nothing.

12. *Q.* Then you would have to be living on your method of storing water?—We are living on it now. We always try when the demand is hot to run down as much water as we can; it is generally more economical, and that very soon becomes more than the river can give us. The demand is increasing; the river supply is decreasing.

13. *Q.* (*Mr. Muir-Mackenzie.*)—Do not you get full up in January or February?—Two years ago we more than filled up; we could have filled up three times over; that was an exceptionally wet year. The river and the canal just balanced this year at the beginning of November. The water could be seen running over the shutters for some days afterwards as a freshet came down.

14. *Q.* What state are the Ken and Dassan projects now in?—I am afraid I cannot tell you very much about them. They are not in my charge. They are directly under the Chief Engineer. The Ken Canal project has gone up for the sanction of the Government of India. I do not know what state the Dassan project is in.

15. *Q.* Can you tell about the Pahuj? Is there any water in that?—Practically nothing.

16. *Q.* There is the Burma?—It is a very small stream.

17. *Q.* I understand that the basin of the Betwa is a very large one; the rainfall is a very fair one; the soil, hard rock, would enable you to store a great deal of water; and I suppose that really a very small portion is stored?—I think about one-tenth of one per cent. if so much.

18. *Q.* We heard yesterday that where there are these storage tanks they practically do their own catchment business; there would be no object in making them bigger?—What we call the lakes, yes. The Barwa Sagar and the Bela Tal are always full, and they would probably bear a little increasing but the others are rather bigger than their catchment, already.

19. *Q.* In your letter of 18th September 1901 you say that you have inspected several sites?—There were two methods of storing water suggested; and I was told to investigate the question. My conclusion was that the only practical one was dam across the river Betwa. The other alternative was the finding of suitable sites for large reservoirs in side valleys.

20. *Q.* Have you made an investigation of this great basin?—No, only a little of it with Mr. Silberrad. There is an enormous basin and a great deal of it is in Gwalior and the Central Provinces.

21. *Q.* There should be no difficulty about making it?—No. It was impossible at that time to do anything beyond making a preliminary inquiry; I had not time for anything else.

22. *Q.* Do you think that the four sites in side valleys inspected by you are really favourable?—Not for very large storage.

23. *Q.* As large as above Parichcha?—No, I do not suppose that the whole lot would be a hundredth part of it. Parichcha is an enormous reservoir, 12 to 14 miles long, with 2,750,000.000 of cubic feet of available water. We want about twice that at least.

24. *Q.* With respect to the Betwa, it is with a view of damming it?—Yes. I saw two sites. One is the lowest down the river of the proposed dams. I think it is about 40,to 50 miles above Parichcha; and the other one is the one which I think is the most promising, but it is the farthest away and is situated on the borders of the Central Provinces on the main river.

25. *Q.* Have you any idea how much the storage would be?—I think the figure is nearly a thousand millions.

26. *Q.* What is the limit in a case like that? Is it that you would spoil valuable land to raise the dam here—No, the limit is the cost. It is cheaper to make two dams than to make one big one, because of the enormous increase in the section of the dam as you get down. At the upper site you could make a dam 100 feet high or more.

27. *Q.* You think then that you could largely increase the irrigation from your canal if you had the water to do it?—I am certain, when the improvement of distributaries has been completed. An instance is what I mentioned just now. We lost the whole of the *kharif* that we might have had this year; we had not water enough; we had used it all for the *rabi*. As a matter of fact, a few hundred acres of *kharif* had been done with *paleo*. But if we had had the water, instead of this being a few hundred, it would have been a few thousand acres carried to maturity. As the water-supply failed, we had to remit the water rate on the *paleo*.

28. *Q.* (*Mr. Muir-Mackenzie.*)—What is the meaning of *paleo*?—Water sent on to the ground to enable them to plough. After the rains it is generally done with the rains moisture.

29. *Q.* Have you establishment enough to work out the design of one of these big tanks?—Not enough to do it as quickly as I should like. I cannot spare the establishment at all now that the irrigation has begun.

30. *Q.* Any chance of getting adequate men from outside?—Yes, plenty of men if I had the money. A survey was done to a certain extent by Mr. Thornhill in 1882, and we simply want to verify this and get a few additional levels and sections and it would not take a month to get the scheme out.

31. *Q.* (*The President.*)—Could you lay your hand on 10 surveyors?—Yes. The real difficulty would be the supervision; it is a question of money. We have not the establishment in the Department at present.

32. *Q.* It is a matter of a few hundred rupees?—And the matter of getting the men. I can get the men to do the actual survey work.

33. *Q.* (*Sir Thomas Higham.*)—Have you any estimate of the cost?—We have one estimate taken out completely for one reservoir dam and we have the rough estimates for the whole six, but the rough estimates were made several years ago and they are insufficient.

34. *Q.* You have only seen two sites?—Yes.

35. *Q.* Have these been estimated for?—One of these has been estimated for (map).

36. *Q.* What do you submerge in the latter?—All jungle. A bit of Gwalior territory will be the only trouble about it. That will be 6 or 7 hundred millions.

37. *Q.* How much do you want?—Double what we have—an additional 3,000,000,000.

38. *Q.* What will that do?—It will secure *rabi* in a dry year and also *kharif*.

39. *Q.* The *kharif* at the end of a dry year?—That would depend entirely on the river. In a year like 1899 it would not secure early *kharif*; in a year like 1896 it would.

40. *Q.* That is to say, if the water is not wanted for the *rabi*?—The *rabi* will be generally done from the river supply.

41. *Q.* But whatever you could do with storing water it would not bring you much in from a revenue point of view. Would you not be able to do more than three or four thousand acres?—Not much more.

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42. *Q.* Is it worth while making the reservoir for that?—I think so; for that and the other advantages of the additional irrigation in a dry year.

43. *Q.* What is the one estimated for going to cost?—7 lakhs.

44. *Q.* (*The President.*)—It would not be very profitable if you had that storage to use it for the *rabi*.

45. *Q.* (*Sir Thomas Higham.*)—If the rain came down for the *rabi*, it would be used for the *kharif*?—With a downfall of rain in the *rabi* we should fill our reservoirs again and use the water for *kharif*. It would not often occur.

46. *Q.* You fill any hiatus in sowing? If you could double the amount of water, you would use it all in the *rabi*?—Yes.

47. *Q.* (*Mr. Muir-Mackenzie.*)—In a year of good rainfall?—No, in a year like the present. This is an average year, rather against the canal and for the cultivator, if anything. But it all depends on the cold-weather rain. If there is none this year as last, we shall use every drop we have by the end of the *rabi*. If there is good rain, we shall be left with a reservoir full no doubt. It all depends on two inches of rain in the cold weather.

48. *Q.* Why you want to develop the *kharif* is because you have a standing supply in your reservoirs?—And to improve the country generally.

49. *Q.* (*Sir Thomas Higham.*)—You say your 900,000,000 would cost you 7 lakhs to store?—About.

50. *Q.* If you have four times that quantity?—The others will be much cheaper; the sites are better.

51. *Q.* This is a prohibitive rate?—It is not the reservoir I advocate to be the first to be made. We shall have an estimate for a very much better one as soon as we can spare time to make it out. We have rough surveys; we simply have to develop them.

52. *Q.* What extra irrigation do you expect to get from *rabi* irrigation?—It may be either in *rabi* or *kharif*. It will depend on the season.

53. *Q.* What will the storage give?—I think it is about 40,000 to 50,000 acres *rabi* and 4,000 or 5.000 *kharif*. There is not a very strong demand at present in an average year; it would all be worked up gradually.

54. *Q.* You say here that the cost roughly estimated is 15 to 16 lakhs. What is that the cost of?—The 3,000,000,000 cubic feet of water.

55. *Q.* Do you think it would come to that?—I think it is a very liberal estimate.

56. *Q.* It does not appear a liberal one from this?—Yes, the figure should have been 9 hundred millions, not 7.

57. *Q.* The other one up here would be very much larger?—Yes. There is a large natural store of water below the rock, and by tapping that we should get at least 200,000,000 more.

58. *Q.* Are any of these on tributary streams?—All are on the main river.

59. *Q.* You cannot depend on these others?—They are not so certain as the main river, but two of them are very fair catchments. However, the estimated volume of storage is very small on them.

60. *Q.* I understand that you only charge 8 annas an acre for the irrigation of *mar* and *kabar* that goes on in September?—The charge is 8 annas. All crops that take one watering are charged Re. 1 flow and 8 annas lift.

61. *Q.* That is any soil?—Yes, except *mar* and *kabar*.

62. *Q.* And *mar* and *kabar* are only half that?—Yes.

63. *Q.* I asked because I infer from this statement of yours, on page 32, that you considered an increase in the *mar* and *kabar* areas in 1896—a steadily maintained increase. But I now understand, which I did not when Mr. Laurie was here yesterday, that the increase has been by the lowering of the rate very much?—No doubt that has had some influence, but the increase is also very much due to the fact that they have found out that irrigation is very beneficial. In *kabar* they have always irrigated fairly well.

64. *Q.* (*The President.*)—It would depend when this change was made?—In 1896-97. In 1897-98 the area was 7,000; in 1898-99, 12,000; in 1899-1900, 10,000; in 1900-01, 10,000; in 1901-02, 15,000.

65. *Q.* (*Sir Thomas Higham.*)—That has been obtained by reducing the rate?—To some extent. I think both influences have been at work. They find that black soil will take irrigation.

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66. *Q.* You think that in good years irrigation does not increase the value of the crops at all on the Betwa Canal?—As regards *mar* soil it does not.

67. *Q.* And the other?—In the *purwa* it certainly does. The latter is practically the same as the Doab soil.

68. *Q.* Even if you had good rain the *purwa* soil is benefited by irrigation?—Very little then; but that only occurs once in 15 years.

69. *Q.* Have you anything to say on the question of the financial failure of the Betwa Canals?—I think the main reason is that the cultivators are not yet used to the canal, and that they are a very slack lot and will not take anything of the kind till they are taught.

70. *Q.* If they will not have rice you can run on their *jowar* in September?—We could in a dry year.

71. *Q.* Would it ever affect materially the financial position of the canal?—Most certainly. If we could get rice introduced, it would very much affect the financial condition of the canal.

72. *Q.* Is it necessary to have that early *kharif* supply to get a rice crop?—That is the trouble. Most kinds of rice can be grown after the rain has broken, but none about here that I know of. There is a good deal of rice near Jhansi. For three years running the rice below a tank which I know was an absolute failure, because the rains broke so late. The intention of that tank is to irrigate rice below in the rains and then to run the water off and cultivate the bed of the tank.

73. *Q.* Is it broadcast rice?—I have never seen it planted. From the look of it it is broadcast.

74. *Q.* (*Mr. Muir-Mackenzie.*)—I see from your rainfall statistics that there has been very good rain in June on the canal in 8 years out of 10? In the last three years, since I have known the Betwa Canal, there has been no rain till the middle of July.

75. *Q.* I mean 1891-92 to 1900-01. There are only two where the rain has broken in July. In most Junes it has been over 7 inches; once over 9 inches?—In 1900 there was no rain worth mentioning.

76. *Q.* That is in Jalaun. I do not know whether it will refer to Jhansi?—Not necessarily.

77. *Q.* (*Sir Thomas Higham.*)—July is the sowing time for rice?—That is the time for transplanting it.

78. *Q.* Broadcast rice?—Yes, they sow broadcast rice in Dehra Dun as soon as the rains are down.

79. *Q.* You think they would do that?—They will have to be taught; they are not accustomed to it and are a slack lot.

80. *Q.* They have had a good many years to learn it in?—There has been so often the difficulty of the water supply in the canal.

81. *Q.* You can always have plenty of water as soon as the rain falls. You do not open the canal then?—We have had nothing to open it for so far.

82. *Q.* The rice is waiting for the water and the water is waiting for the rice?—I do not think that the rice is waiting for the water. Cultivators have made no arrangements for sowing rice. Nor will they do so until they are taught.

83. *Q.* (*Mr. Muir-Mackenzie.*)—With this rainfall in July, if the cultivators wanted to sow rice at all, would not they have had enough rain without the help of the canal? The average of July is 8½ inches?—It would be enough if they cared to do it.

84. *Q.* I do not see that the canal is responsible for their not having rice?—If rice is to be introduced, we shall have to teach them rice. I have spoken to them about it and they say that they do not understand rice. If we could find some rice that would grow when sown in July, the canal would develop the area, especially when rain failed.

85. *Q.* I do not quite understand on what you base your hope that in a year of good rainfall you would extend your irrigation if you had this increased storage. Do you find that the people are more disposed to take water than they were?—They are certainly more disposed to take water than they used to be and increasingly so.

86. *Q.* Is that not only on account of successive bad years?—I think not. I think the new settlement now going on in Jalaun District has something to do with it.

87. *Q.* What has that to do with it?—In one or two pergunnahs the settlement has been done and they are keen on extending cultivation and irrigation because the land has been assessed as dry and in large areas as u[illegible]ted.

88. *Q.* Then they will have to pay wet rates?—Yes, but less rent.

89. *Q.* We have heard that the landlords can raise rent with the greatest facility in this country?—That was Lalitpur.

90. *Q.* I thought it applied to the whole of Bundelkhand. Is not that the case in Jalaun?—I cannot say certainly about that.

91. *Q.* I confine myself to the apprehension that, given good years, irrigation would go down. Even now in 1899, 1900 and 1901 they were pretty bad years, but you only had 32,000 acres and 30,000 against 27,000 in 1890?—In 1899 we had only 32,000 because we had no more water and we had to remit irrigation revenue on some of the land irrigated because we could not give water.

92. *Q.* In 1900-1901?—We had a tremendous lot of rain and they did the whole of the 34,000 acres by the 15th of December. Rain broke after a great part of the irrigation had been done and we were left with our reservoir full at the end of March.

93. *Q.* Did you manage to start the *kharif* in 1901-02?—Yes. But they had had none the year before on account of exhausted reservoir, and they had got disheartened. The area was about 2,000 acres. For this *kharif* just past (1902) it was the same as before when there was no water.

94. *Q.* If you had had this extra storage in 1896-97, would you have irrigated double the area in the *rabi*?—I do not think that we could very well have disposed of the water as the canal then stood. No improvements had been made then and the channels were all contracted. With the improvements finished which are now in hand we could certainly have done it. You may notice that the area of last year 1901-02 was 48,000 and the area in 1896-97 was 62,000. Last cold weather was by no means a famine year; it was a dry year. We began irrigating much later than in 1896-97 and we had 48,000 acres against 62,000 in a year in which every drop of water was made the utmost of.

95. *Q.* In improving the channels are you doing anything in the direction of taking more water on to better classes of soil—the *kabar* and *purwa*?—No, we are not doing anything in that direction. We are allowing the water to go where it will be taken. At present the Betwa Canal requires general encouragement more than anything else.

96. *Q.* Is it not possible to carry the Betwa water to a larger extent into better soils?—No. There are only small extensions of present channels possible, running them a little further on. There are very few new tracts of the better soils we can go into; practically none.

97. *Q.* In these days when you have very little water what is the system? Does the cultivator help himself to the water when he wants it?—The system is the same throughout these provinces. You have the distributaries running down the country and the distributaries have the outlets and from the outlets the village channels are carried about over the fields. When the water is passed down the distributary the cultivator takes the water when he wants it. We feel the pulse of the demand and let the water through the distributaries according to that.

98. *Q.* You do not find, with that system of everybody taking the water when he wants it, without warning you beforehand, that it leads to your being short of water later on for a second watering?—No. Of course we have to watch. We know pretty well how many waterings a field can do with, and if there is any risk of running short of water, we should issue notice and put on periodical closures, not so as to stint them in any way, but to prevent any risk of waste.

99. *Q.* You did mention that you had to remit because you had not been able to give water?—That was because our channels were in a tight state; we could not get the water down and we wasted a good deal in shoving it along. Now we can run it down in large volumes and satisfy everyone simultaneously.

100. *Q.* You are satisfied that under this system you can so feel the pulse of the demand that you run very little risk of stinting anyone?—I think so. That is my experience. Mr. Laurie, now on the Betwa Canal, is having exactly the same experience now (middle of January) and is doing very well.

101. *Q.* We have been told in Bombay that you must have an application beforehand for water in order that the Canal Department may be fully aware of the drain likely to be made upon it?—I suppose that is where the supply is very limited indeed. It is not necessary here.

102. *Q.* But your own supply is limited?—Yes, but we can always reckon on enough to see the *rabi* through. Sowings are only effected in a certain period; that of course we are bound to see through. In a year of big demand there is much done in the fields sown with rains moisture. If they can get water on to that, it is all the better for them and for us, but we have no responsibility there. The whole system is divided in to reaches of a few miles with a patrol in charge and he reports every two or three days thereon to the zilladar who is the Revenue Officer; he keeps the Executive Engineer informed.

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103. *Q.* Have you any opinion regarding this scheme for making a number of small tanks mentioned by Mr. Silberrad?—I have seen a little of Lalitpur, and I think the scheme would be of very great benefit.

104. *Q.* Could they be made to give any return—not necessarily a full one?—Some, but most of them could not. They would all do good of course.

105. *Q.* Could the Irrigation Department take the work up?—Within limits I think they ought to take it up.

106. *Q.* Wherever the tank irrigates 100 acres for instance?—I think so.

TWENTY-SIXTH DAY.

Agra, 15th December 1902.

WITNESS No. 48.—MR. A. W. TRETHWEY, Collector of Muttra.

(*Replies to printed questions.*)

Mr. A. W. Trethwey.

15th Dec. 02.

A.—GENERAL.

Question 1.—To Muttra district where I have been posted for a year.

Question 2.—The average rainfall for the last seventeen years has been as follows:—

January	·59	July	8·04
February	·61	August	8·79
March	·20	September	4·14
April	·09	October	·20
May	·36	November	·12
June	2·97	December	·35
		Total	26·46

Question 3.—The short supply and the bad quality of the well water are serious obstacles to the extension of irrigation. These features are noticed below.

Question 5.—Loans are freely taken. I do not think that it would be wise to encourage the construction of wells by granting *takavi* on easier terms, because in many cases the outlay is apt to be unproductive owing to causes explained below.

Question 6.—Extension of irrigation has a tendency to attract cultivators from dry tracts. In the report submitted from Muttra about the recent census it was stated that there had been emigration from Native States to the western tahsils of this district irrigated from the Jumna Canal. Mahaban tahsil, east of the Jumna, in which irrigation is particularly precarious, showed the smallest increase of population at the census of 1901; probably there was some emigration from it during the years of famine. In 1896 ten thousand persons are said to have gone from the eastern to the western tahsils when the distress first became felt; most of these probably returned, but some must have remained behind. When I was in Cawnpore I was struck by the decrease of population in the villages on the Jumna, and came to the conclusion that a number of labourers had emigrated to the neighbouring tract irrigated from the canal. This was one of the chief reasons for the deterioration of the villages.

There is a clamour for canal water in all the villages of Muttra which do not get it now, but could get it if one of the schemes for extension were carried out. The Mat branch extension in the east and the Nandgaon distributary in the west are the most important projects. Whenever I visit the villages which will be commanded by these works the people always ask for the latest news of the canal. A common phrase used to depreciate a village is "there is no canal water here." The rainfall has been so scanty in recent years that cultivators consider agriculture unaided by canal irrigation an unsafe occupation. I except of course *khadir* lands and other favoured tracts. I have never been in a district where the canal is so much blessed.

B.—CANALS OF CONTINUOUS FLOW.

Question 7.—I should say that in Muttra the greatest benefit received from the canal in an ordinary year is the cotton crop sown in May or June after previous irrigation and picked in October.

It is this early cotton crop, safe and good, which chiefly excites the envy of cultivators who cannot get canal water.

Question 11.—I have seen *reh* in places near the canal and should ascribe it either to percolation or to excessive irrigation. I believe that *reh* is brought up from the soil, not that it is deposited by water. It is not now a serious evil, but it may assert itself if we have a series of wet years, and was once very bad in the Muttra tahsil before the drainage cuts near Chhota Kosi and Perkham were made. I have seen land along the Muttra-Chhata road and elsewhere which looks sour without actually producing *reh.* I attribute its condition to continued irrigation without manure. The area is not large. To check excessive irrigation rates may be raised or water may be absolutely withdrawn for a year or two. I believe that the second plan would be the more effectual and should like to see it introduced experimentally in selected areas.

Water-logging is, in my opinion, a very serious danger in Muttra district. Drainage cuts have been constructed in Muttra tahsil and have been very beneficial. A drainage cut is urgently required in Chhata now: the project has been prepared, and I believe that work will soon be started. Artificial drainage is required because there are no natural drainage lines. The Jumna, which runs through the district, receives little water on its western bank, as it has a long ridge running parallel to it. This ridge is pierced by no ravine of any consequence between Gurgaon (Punjab) border and Muttra city. The soil has to absorb all the rain. It is a significant fact that the spring level in the wells has risen in many places in the western tahsils, while it has fallen in the eastern. The reason is that there is canal irrigation west of the Jumna and practically none in the east. Canal irrigation has not only put more water on the land, but it has also checked well irrigation—a most important means of diminishing the sub-soil supply of water. I could write much more on this subject, but feel that I am trespassing on the province of the engineers. I will merely say that if we have a succession of wet years before this drainage scheme is carried out, the situation may become serious in the north-west of the district, and that in similar tracts the extension of canal irrigation should always be followed by an increase in the facilities for drainage. I say "followed" not "accompanied" because just now after the series of dry years a rise in the spring level will be absolutely beneficial; when the sub-soil water has reached its former level its further rise must be controlled. I have studied these questions in the Cawnpore and Farrukhabad districts, in each of which I was posted for more than four years, but I say nothing of my experience there, as I am restricted by the Board's letter to the conditions of the Muttra district.

D.—TANKS.

Question 23.—There is very little irrigation from tanks in Muttra district. There are a great many tanks, but none hold enough water to be a considerable factor in the agricultural situation. They receive their supply from the drainage of the immediate vicinity; the plan of putting a dam across a natural drainage course is not practised. I fancy that one reason why tanks hold so little water is that the earth at the bottom and sides absorbs so much.

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Question 32.—In a great part of the district the people have religious scruples against irrigating from tanks, thinking that the proper use of tanks is to supply water for the cattle to drink during the hot weather. Nowhere, as far as I have seen, does the construction of tanks give a sufficient return for the capital expended to deserve encouragement. The water is often so far from the surface that it has to be raised by bullocks as if it were in a well instead of being baled out. I have noticed some shallow depressions in Eastern Muttra where possibly enough drainage might be collected to fill a large shallow tank, but only an engineer can say whether such a project is practical. Subject to this possibility I think that tanks may be altogether disregarded in searching for a source of irrigation to extend. They count for nothing at present.

E.—WELLS.

Question 34.—(1) When revising the District Gazetteer I wrote as follows:—

"The distance of the water level from the surface is 75 feet in tahsil Mahaban; 60 feet in Sadabad; 50 feet in Mat; water has sunk a great deal in these tahsils in recent years on account of dry seasons. In the *cis*-Jumna tract the depth depends much on position with reference to the canal; in many villages of Chhata situated near the canal or its distributaries water is only 10 feet from the surface: it does not rise so high in Muttra as drainage has been done round Chhota Kosi and Perkham; away from the canal the average depth is from 30 to 40 feet; the greatest depth is in the middle of Muttra tahsil and in the west of Chhata."

Regarding the remaining points mentioned in 34 the *Muttra Gazetteer* published in 1884 may be consulted, but it should be noted that the wells in Eastern Muttra have deteriorated both as to quantity and quality of water since 1884. Pages 45—47 give some useful information about the methods and cost of construction. In connection with the project for the Mat branch extension of the Ganges Canal, Mr. Evans, Executive Engineer of the Irrigation Department, has explained the deterioration of the wells in the eastern tahsils. The Director of Land Records and Agriculture is making an enquiry into the constituents and properties of the various kinds of brackish water. I can add little to these sources of information. Just now many people think that the drought has made the well water more brackish than it used to be, because it has allowed less dilution with rain water. In former times the canal was accused of turning water brackish (see page 25 of the *Gazetteer*). It seems to me that the quality of the water depends on the stratum in which it is found: any agency, whether drought or drainage or excessive rainfall or percolation from a canal which lowers or raises the spring level, is apt to change the nature of the water-supply. I have heard of cases in which wells formerly brackish have become sweet from the effects of the canal.

Question 38.—(1) Yes. In many places it is impossible to say whether sweet or brackish water will be struck.

(2) It is often very difficult to cope with the sand.

I understand that the Director of Land Records and Agriculture can supply an expert, but I do not think that any expert can give a better opinion than the people of the village. Except in a very small part of the district there is no rock: the borings are made through loam and sand.

Question 39.—Certainly not. There are plenty of people ready to make wells where wells are required: there is no reason for employing Government agency.

Question 40.—Temporary wells are not very much used in the district except in the eastern tahsils. They were never very common in the west, and owing to the rise of the spring level caused by the canal are harder to mak now than formerly. In the east they have become less numerous, because owing to the fall of the spring level they give less water and that often brackish. The difficulties caused by sand in construction have also increased. In fact they are not often satisfactory now. The danger of striking brackish water which will be unsuitable for irrigation prior to sowing is the chief obstacle in the way of increasing the number of temporary wells to meet an early cessation of the rains. One sees lots of wells too brackish to be used prior to sowing, and therefore idle in November which will give water or rather liquid manure later on. For some account of the extent to which water may be brackish but suitable for sowing, see the report to be furnished by the Agricultural Chemist to the Director of Land Records and Agriculture.

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1. *Q.* (*The President.*)—I gather that you were in Farrukhabad and Cawnpore?—4½ years in each of those districts.

2. *Q.* I suppose there is not much canal irrigation in Farrukhabad?—Yes, a good deal in Titwa and Kaimganj.

3. *Q.* You gave evidence on the recent census as regards the tendency of irrigation to attract cultivation from dry tracts. Is that a complaint made by the people? Where there is no irrigation are they restless? Do the zamindars complain that they cannot get the cultivation done in the dry tracts?—It came to my notice when I was revising the settlement of some villages in Cawnpore. I heard complaints of people having left villages and saw a number of ruined houses which generally belonged to Chamars, who had moved over into the canal irrigated villages close by.

4. *Q.* Why was that?—It had no reference to the famine. It was before the famine.

5. *Q.* You are favourable to the construction of the Mat branch and Nandgaon distributary?—Very much so.

6 *Q.* Is cotton cultivation increasing in Muttra?—Very much, because the last few years have been rather dry and therefore favourable to cotton, but this year the crop has been not a failure, but a good deal below the average. In Chhata tahsil of Muttra this year the *jowar* was also rather bad, though in the Mat tahsil it seemed to me to be particularly good. I was told that the people gave all their labour to the cotton and did not bother about *bajra* or *jowar*.

7. *Q.* The cotton is west of the Jumna?—All over the district, but the canal irrigated cotton is all west of the Jumna.

8. *Q.* The Mat branch does not yet come into your district?—A very little bit, not worth counting. There has been canal irrigation of a few villages on the Aligarh border.

9. *Q.* I do not think we used to irrigate early cotton much on the canals.

10. *Q.* (*The Secretary.*)—It is confined to Aligarh, Agra and Farrukhabad?—They sow this in May and pick it in September.

11. *Q.* Is it especially good, forward cotton?—Extremely. High and plenty of wool.

12. *Q.* In any of these districts which you have served in, has it come to your personal knowledge that land thrown out of cultivation by *reh* has been brought back again by drainage?—Yes. I can give you an instance from Muttra. All the villages down by Parkham suffered very much from *reh*, and now there is *reh*, but they are in a very much better state. I went over there last cold weather and made inquiries about it. There has been some drainage done there, and possibly a change in the seasons has had something to do with it.

13. *Q.* Has this Chhata drainage moved on at all?—Yes, it has been sanctioned and land taken up for it, and they are making a syphon under the canal at the present moment.

14. *Q.* Has the irrigation from the Agra canal become so intense as that it would be wise to lay down a certain maximum percentage of the area to be irrigated?—I should not restrict irrigation in that way. It might be worth while to stop irrigation for a year as an experiment. I would not do it all over the Agra canal, but in one or two villages. It would not be conclusive as an experiment, because you could not stop the main canal, and I fancy there is much more percolation from the main canal than from distributaries, chiefly because the main canal is always running, and distributaries are more often closed. The villages which have suffered from *reh* are all close to the main canal. I am not prepared to say there may not be others.

15. *Q.* There used to be a feeling when these canals were under construction in the sixties that one-third is about as much as any one village should have irrigated of its culturable lands, partly in order to spread the water far and wide and partly also to prevent over irrigation and water-logging of the village?—I do not think that irrigation water-logs a village except indirectly. It has a tendency that way by stopping well irrigation.

16. *Q.* And by raising the spring level in wells?—Probably that comes not from the actual irrigation, but from percolation from the canal and distributaries.

17. *Q.* (*Sir Thomas Higham.*)—And are not large areas broken up by cultivation?—I do not think that a larger area is broken up for cultivation on account of canal irrigation.

18. *Q.* Is not the canal extended to waste lands?—Not in Muttra. Cultivation was general before and, so far as I know, not in Farrukhabad or Cawnpore. I cannot say that waste land has ever been broken up on account of canal irrigation.

19. *Q.* (*The President.*)—I expect you would find it was 30 or 46 years ago?—It may have been before the settlement. My experience in revising settlements in Farrukhabad and Cawnpore has been that the cultivation was at a very high level at the settlement.

20. *Q.* The settlement being when?—About 30 years ago.

21. *Q.* Farrukhabad had no canal irrigation 30 years ago?—Farrukhabad had the Cawnpore branch going into Cawnpore, through the Titwa tahsil. It might be advisable to restrict canal irrigation in a village for the reason that they used no manure. A canal water without manure is an evil. The land gets exhausted, and if the people are allowed to take water whenever they can get it, particularly when canal irrigation is first introduced, they use it without any manure at all and get two or three excellent crops off the fields.

22. *Q.* That means that a smaller proportion lies fallow?—It is not quite that, but that an irrigated crop is so much better than a dry one and therefore takes more out of the soil, and they put two crops on where before they would put one. In this connection a canal officer would be able to tell whether there is any difference between lift and flow. My impression is that lift irrigation is better for the land.

23. *Q.* A number of people think that. Do you find that the system for the distribution of water and the revenue management is satisfactory in the districts you have served in?—I think it works very well. People have come to me to complain in all districts and the answer I invariably give is "go to the canal officer first and get a copy of his order," and I have never known a man come to me with a copy yet. I suppose I have given that answer hundreds of times.

24. *Q.* Of course it is always the game of malcontents to play one authority against another. You would not suggest any material change?—No, I do not see how a revenue officer can interfere in these matters. It is the business of the canal officer to see to the distribution of his water and we have not the necessary knowledge. Sometimes I have addressed canal officers on the question, but only very tentatively. I could not put my opinion against that of canal officers.

25. *Q.* (*Sir Thomas Higham.*)—Do you think that canal irrigation in Farrukhabad or Muttra district has made any deterioration in the soil?—I have noticed the increase of *reh*. To take Farrukhabad, there was certainly water-logging there. That I believe has been relieved by drainage, but whether that water-logging was due to the canal or to successive years of excessive rainfall was open to question. The excessive rainfall coincided with the introduction of canal irrigation.

26. *Q.* I am thinking more of the exhaustion of the soil by heavy cropping? Yes. I have seen that. I have seen fields both in Farrukhabad and Muttra which have got to such a state that they could not give a crop worth speaking of without canal water, and would hardly pay rent with it.

27. *Q.* Is there any rule as to the area of a village to be irrigated?—None that I am aware of.

28. *Q.* Have you any idea of what the general percentage is?—It is a difficult question to answer. Some villages are getting the whole of their area irrigated, whilst in others canal water can only just touch one corner. I do not quite see how you can have a limit.

29. *Q.* But it is a question of supply. If a village has a thousand acres, you can give it enough water for five hundred acres?—Would not that mean that some people whose fields were more favourably situated would get the water every year and the rest of the village get none?

30. *Q.* No. Fifty per cent. of the land of each water-course would get water?—You would then have to decide which fields would get it each year.

31. *Q.* The owner of the water-course would decide that; make out a list of turns?—Would not they fight and those at the top of the water-course always get the water before it goes down below.

32. *Q.* I do not think so. If you give water to the whole village you get no fallow?—There is really very little fallow. If the year is favourable and the village is well populated, they change the crops, but do not leave any fallow.

33. *Q.* It cannot be a good thing to have an irrigated crop on the land every year? -If you use enough manure, I don't think there is any harm.

34. *Q.* But they do not use enough?—If there is too much land irrigated, they will not have manure enough for the whole of it.

35. *Q.* Would it be a good thing to restrict the supply to a certain percentage of the culturable area?—You would have to go further than that and decide which fields should get it each year. I must say it is a question that I have never thought of before.

36. *Q.* In the new branches in the United Provinces they do restrict the supply, I believe, but I am thinking of the old irrigation?—If there is a rule, it is not observed. But villages do not irrigate the whole of their culturable area, because there are some *kharif* crops after which no *rabi* crops can be sown. You cannot very well sow anything after *jowar*.

37. *Q.* I mean in the year?—Where you have a rain crop that will ordinarily not be followed by a *rabi* crop, you cannot follow cotton with anything very well, because the cotton is picked right into November.

38. *Q.* (*Mr. Roberts.*)—Do you know the respective areas of *kharif* and *rabi*?—About half and half. Perhaps the cotton might make the *kharif* more.

39. *Q.* (*Sir Thomas Higham.*)—There are no other means of irrigation in Muttra than canals and wells?—In wells there is not much more to be done. They are difficult to make on account of the fall in the water-level and brackish water. Wells have been made already wherever a well will pay.

40. *Q.* (*Mr. Muir-Mackenzie.*)—The number is very large apparently?—Very large on the eastern side of the district, but on the western it is not large. There are practically no *kachcha* wells on the western side.

41. *Q.* (*Sir Thomas Higham.*)—Are there wells in the canal irrigated area?—Yes.

42. *Q.* Are the canals driving them out of use?—A good many. But sometimes they use a well, not so much for water as for "liquid manure." Even after the canal water has been used they will put their own well water on on account of the chemical properties of it.

43. *Q.* (*Mr. Muir-Mackenzie.*)—Has the water been analysed?—An inquiry is being made by the agricultural chemist of the department. I have sent up some specimens of water.

44. *Q.* In Gujerat some wells have good properties for tobacco?—There are some parts in Kaimganj in Farrukhabad that grow a tremendous amount of tobacco. These wells with brackish water will fetch two or three times as much rent as sweet water.

45. *Q.* (*Mr. Roberts.*)—Sometimes the difference is between Rs. 50 to Rs. 80 and Rs. 5 or Rs. 6?—They get three crops off them. In Muttra there is practically no *oosur* on the surface, and it has occurred to me that this is possibly the reason why there is so much brackish water. The well in my garden leaves a deposit which one might very well take for *reh*. So far as I have seen in these provinces, there is no brackish water outside Muttra and Agra, except near old sites like Kaimganj. In Muttra brackish water is very common, and there is no *oosur*. Is it not possible that, owing to difference of rainfall and soil in the Doab and Oudh, the *oosur* gets to the surface and is got rid of in that way, whilst in Muttra it stops down below and affects the water?

46. *Q.* (*Sir Thomas Higham.*)—It comes to the surface where you have canal irrigation?—Yes, because your canal irrigation supplements the deficiency of rainfall. I think I have mentioned that in some places wells have actually become sweet after the introduction of the canal, which were brackish before.

49. *Q.* You think the *reh* has been forced up and left the land sweet below?—It seems to me to be probable.

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48. *Q.* (*The President.*)—If there is anything in that, there is all the better hope of restoring the land; if the *reh* will come up so quickly, it will go down again?—In a village, named Kosi, in the Chota tahsil, I noticed that *reh* started at the corner of the field or the side, and generally spread over the field. The people call it a sort of leprosy.

49. *Q.* (*Sir Thomas Higham.*)—Have you known a well that was sweet before the introduction of canal irrigation become brackish after it?—Yes, there are many instances.

50. *Q.* It really depends on the water stratum of the well?—I think so. There is another curious thing. In some parts of Muttra they put a well close to a tank in order to get sweet water, as that is the only way they can get it.

51. *Q.* (*The President.*)—The rain water in the tank supplies the well?—One would expect it to affect the water in the tank. The more one looks into it the more difficult it seems.

52. *Q.* (*Sir Thomas Higham.*)—If you were to have a famine in Muttra now, what works have you to employ the people on?—The last time the programme was prepared we had this Mat branch and the Nandgaon distributary and the railway. That would be enough for the whole district. Now all these have been constructed, or are under construction, so the programme will have to be revised.

53. *Q.* During the last famine all the work in Muttra was on the roads?—Two roads were made.

54. *Q.* What scope is there for small village works in the district?—We might do as much in tanks as we liked with advantage, not make new tanks, because the people would grudge the land, but the old tanks might be deepened and improved.

55. *Q.* You do not think that the tank would do any good?—Not for irrigation; only for cattle.

56. *Q.* And for the improvement of wells in that neighbourhood?—Yes, they might do good in that way. I have pointed out that there are one or two places in the district where I think it possible that tanks might be constructed of sufficient size for irrigation, but that is a question which only an engineer could decide. The difficulty in Muttra is that there is no drainage. We have hills. The "western depression" is an old drainage line.

57. *Q.* (*The President.*)—Have you anything like the Ridge at Delhi, for instance?—Yes, we have two lines of hills. In the neighbourhood of Gurgaon there is a big system of *bunds*.

58. *Q.* (*Sir Thomas Higham.*)—It appears that you have all small works which are mostly metal collection and roads?—Yes, all the Public Works Department ones are, but the small village works would be more useful now. I have a big programme outside this of village works, almost entirely the improvement of ordinary village tanks.

59. *Q.* How many units would your programme employ?—It could employ an indefinite number. Speaking from memory, it was framed to employ nearly as many as this programme—probably 22 millions.

60. *Q.* All these civil works will not be much protection?—For irrigation purposes practically of no value.

61. *Q.* Would you have works done by landlords with assistance?—Very little. They are put in the programme, but perhaps by the time the famine comes the work may be already done or the landlord will change his mind.

62. *Q.* Does the landlord ask you to put a work in the programme?—They are consulted about it. When this Mat branch is constructed and the Nandgaon too, I think the district will be almost entirely protected. There will be two patches which will not be protected—one on the Etah border, but the wells are pretty good there, and the others within the Bhartpore border.

63. *Q.* Do the wells give out during the famine?—In some parts of the district. The water level has sunk as much as 15 to 20 feet in some places since the famine of 1896. The extent of the fall is not general and in neighbouring villages the difference is considerable.

64. *Q.* Did the parts now protected by wells suffer in the last famine?—No; last year there was a drought and we remitted Rs. 80,000; of that very little went to the Sadabad tahsil; only two villages received relief there. All the rest got on with their wells.

65. *Q.* (*Mr. Muir-Mackenzie.*)—I see that a large number of wells are *kachcha* wells. All in the eastern part of the district?—Nearly all.

66. *Q.* How do they arrange to make *kachcha* wells to a depth of 60 feet?—They cannot make them much now; they have to line them with wood. Since the water has fallen it has gone below the *mot*. Sand is met and gives trouble.

67. *Q.* But the numbers have kept up very well. In 1896-97 they were 30,900 and they are still 30,200?—They do make them.

68. *Q.* How much did the district suffer in the last famine?—We had a little famine of our own last year; no relief, but we should have had it there had not been a fall of rain in October. I was not in Muttra in 1896-97. Then we only made these two roads. So there could not have been much done in the way of relief.

69. *Q.* The percentage of the district under irrigation seems so large that it is extraordinary that there should have been any famine. One wonders what percentage of irrigation will ever save a district. According to Mr. Barlow's map there is only one tahsil, that of Mahaban, which has less than 50 per cent. of its area under irrigation. The map was prepared in 1900?—Mahaban is the worst part of the district.

70. *Q.* In Sadabad there is 65·2, in Chhata 59, in Mat 56·82. Was famine relief given in Mat?—There was no work.

71. *Q.* We should never think of giving relief in the Deccan with 38 per cent.; this district has one tahsil only with between 25 and 50 per cent.?—A lot of this well irrigation is nearly useless in a famine year, because the water is too brackish and too scanty.

72. *Q.* (*Mr. Rajaratna Mudaliar.*)—But in 1896-97 the well irrigation was 181,000 acres?—But the crops may be very poor, though they are assessed as irrigated, if the seed will not germinate.

(*The President.*)—There is another thing. We are dealing with a population of quite double of any in the Deccan districts.

73. *Q.* (*Mr. Muir-Mackenzie.*)—No bigger than the population in Gujarat?—I do not know that we have ever had severe famine, but high prices and scarcity.

74. *Q.* As to this deterioration in the cropping from extensive canal irrigation, does it go so far that the crop becomes poorer than the previously existing dry crop?—Certainly much worse. If there is much *reh*, the field may go out of cultivation.

75. *Q.* Does the cultivator not take steps to stop that? Does he not stop irrigation himself?—No; even if he did, I doubt if it would do much good, because the rise in the spring level has as much to do with *reh* as irrigation, I believe.

76. *Q.* You have not much *reh* now?—We had a great deal. There is not very much now. It is not now a serious evil, but it may re-assert itself in future years.

77. *Q.* But the area now is not large?—No.

78. *Q.* Canal irrigation has been going on for a long time?—Yes, for 30 years.

79. *Q.* Is the deterioration you mention due solely to *reh* or also to water-logging?—Chiefly to *reh*.

80. *Q.* May I take it that the total amount of deterioration is not extensive yet?—Yes, but it was greater than it is now.

81. *Q.* But even then was it a large percentage of the area?—Only along the main canal.

82. *Q.* Where *reh* does not occur is the deterioration very serious? Does it make it worse than the dry crop?—Yes, but only very locally.

83. *Q.* Can you tell me at what time the spring level began to fall?—Mr. Alexander, Commissioner of Meerut, who settled some of these villages about 20 years ago, noticed a fall then. But the fall has been very pronounced since the famine.

84. *Q.* But it began before 1896-97?—Yes, in parts of the district.

85. *Q.* You do not want to see *takavi* advanced too largely in this district for wells, but have you formed any opinion as to the advisability of its being freely given elsewhere for the purpose?—I think that if a well will pay, *takavi* advances should be given. I do not believe in throwing *takavi* about simply to make wells.

86. *Q.* You do not believe in pushing it?—No; very often people will not make a well simply because it will not pay. A man may not have a lot of fields together, and you cannot get cultivators to combine to make a joint well.

87. *Q.* The people find no difficulty in procuring capital to make wells where it will pay them?—Generally speaking,

they can borrow the money well enough without taking *takavi*, but a man does not readily incur a debt to make a well. It would be easy enough to push *takavi* if one were not careful of the security.

88. *Q*. The other day in Gwalior we heard that Colonel Pitcher got rid of Rs. 50,000 in one year, with no difficulty about security. That is not so difficult, as it is to be perfectly certain that it would be spent on proper objects. He said he deliberately threw that on one side, and he recovered it all with the greatest ease. You do not think that it would be easy to find security?—The same man who can give you security is not very anxious to take *takavi*.

89. *Q*. Have you ever tried it?—For wells in Cawnpore I gave something over Rs. 20,000 just before the famine of 1896-97 for seed and *kachcha* wells.

90. *Q*. I suppose that the people were anxious enough then to take it?—I gave it for a purpose then, because the local money-lenders were not coming forward, and I wanted to show them that Government was giving money freely.

91. *Q*. Did you depart at all from the usual methods then?—The only way was to give so much to each tahsil and tell the tahsildar to arrange, so that the money could be given very quickly without reference to me.

92. *Q*. Do you think it would be advisable to have some simplification of the procedure for ordinary times?—I do not think so, except for seed. If a man wants Rs. 500, he will take a little trouble about it. It is the way in which it is collected; the man cannot get any extension from Government, whereas a bania will give him time.

93. *Q*. These difficulties have not stood in the way of large amounts being given in other parts of India. There are districts in Madras where they get rid of an enormous amount every year. If you think that the people do not need the money here ....?—I don't think that in Cawnpore and Farrukhabad there is much scope.

94. *Q*. (*Mr. Rajaratna Mudaliar.*)—There are 30,000 *kachcha* wells in Muttra. How long do they last?—Sometimes 5 or 10 years, or more; in other places 3 or 1.

95. *Q*. (*Mr. Roberts.*)—How long on the good land between Muttra and Agra?—Four or five years.

96. *Q*. (*Mr. Rajaratna Mudaliar.*)—The *kachcha* wells are dug by the tenants themselves?—Yes. They are not really *kachcha*; they have to be lined with wood as a rule.

97. *Q*. To what extent are the tenants protected from enhancement of rent if they construct wells?—I have not done much enhancement work myself, but there are doubtless rules about it.

98. *Q*. Does the fear of enhancement deter the tenants?—Certainly not. I don't think we ever enhance for *kachcha* well.

99. *Q*. (*Mr. Muir-Mackenzie.*)—But the lands become liable to wet rates?—We do not take into account the fact of a *kachcha* well being dug, so much as the accessibility of the water.

100. *Q*. (*Mr. Rajaratna Mudaliar.*)—You leave the canal distribution entirely to the Public Works Department?—Yes.

101. *Q*. And the measurements and assessments are also done by the canal officers?—Yes.

102. *Q*. Would you like to see that transferred to the Revenue Department entirely?—Certainly not.

103. *Q*. Does not that take up an unnecessary portion of the time of the professional officers?—If they could make out a case for it, it would be considered, but I do not see why there should be any change.

104. *Q*. In the Madras Presidency the time of the professional officers is devoted to more purely professional work. They attend to the distribution, but the measurement and assessment (the rates are known) are done by the revenue officers. The same staff could work under the Collector?—Yes, but if a man has a grievance he goes to the canal officer. It is a question I have never considered. The more the canal officer goes over his ground the better he will see the difficulties of distribution. He has to go over the ground as it is.

105. *Q*. He has to check the measurement of patrols and a great portion of his time is taken up?—But if he does not go over the ground he cannot do the distribution properly.

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106. *Q*. Is any large area in Muttra cropped more than once?—Not large.

107. *Q*. That would show the deficiency in the canal as compared with former years in Cawnpore and Farrukhabad?—In Muttra, as compared with Farrukhabad and Cawnpore, there is less double-cropped land. There is a big rice crop in Cawnpore, succeeded by *rabi*. Rice does not exist in Muttra.

108. *Q*. (*Mr. Roberts.*)—As to *takavi*, in Muttra you have worked up to your limits nearly every year?—Yes.

109. *Q*. Have you had occasion to ask for more money and been refused?—Not in Muttra.

110. *Q*. There is one year in which for improvements under the Act of 1883 you advanced Rs. 32,000. The repayment of that must be going on now, I suppose?—Yes.

111. *Q*. What was that for?—It must have been for wells in 1900. That was a year of drought, almost of famine. A *pakka* well for two skins would cost about Rs. 500; *kachcha* wells are also included.

112. *Q*. You fell down from that to Rs. 6,000 a year. That would seem to indicate that there is scope for further *takavi* advances for *pakka* wells in Muttra?—I do not think so, because this year I had the balance of agricultural loans transferred to land improvements, and I have not spent much of it. I have asked in the villages several times myself and people say they will take it. But one man may have no security, and a man who has security will not turn up in my camp to take the money.

113. *Q*. Are the advances for *pakka* wells given mostly to zamindars or to tenants?—To zamindars almost entirely—small zamindars.

114. *Q*. The reason that tenants do not get advances largely is because they cannot give security?—Yes. But I think that the great difficulty is that a man has not often enough fields together to make it worth while to make a *pakka* well. A *pakka* well would want 20 acres and that amount of land is rarely owned by one man in one place.

115. *Q*. That is a real difficulty. It has not been given before?—And the favourable situations for wells have been taken up already.

116. *Q*. We have been told that in other parts the custom is against a man appropriating all the water of a well he has made?—Yes, they must be entitled to get it, for one never hears of cases of taking water brought forward. It would be a very fruitful source of dispute, one would think, if there were not a custom.

117. *Q*. In Muttra all the tanks are artificial excavations?—Yes.

118. You have no *jhils*?—None at all.

119. *Q*. Or any valleys bunded up?—No.

120. The reason why these ordinary tanks are not used for irrigation is that they were not made for the purpose of irrigation?—Yes.

121. *Q*. And they are all of very small size?—Some are not very small.

122. *Q*. (*The President.*)—If you come to irrigate from them they would not go far?—No, and besides they must make a well even then. I do not think that I have ever seen water baled in Muttra district. They make a well in the margin and make a cut into it from the tank, so that the well is actually connected with the tank.

123. *Q*. Have you any other point to mention?—Concerning navigation in canals, I should like to see it abolished altogether, because it interferes with the supply of water sometimes.

124. *Q*. Is navigation kept up always between here and Muttra?—They stop in the rains sometimes, but there have been cases in which they have kept water in the canal for the sake of navigation when it would be better out. I should like to see the canal dry in the rains as a rule. And then there is another difficulty on account of navigation. We have to make much more expensive bridges than would be otherwise necessary. There is a village in Muttra which is bridged about a mile away. There people are always asking for a bridge, but the expense of one would be prohibitive. I have known in the famine year the canal running full for the sake of navigation and water running to waste at the tail when people were crying for it in the upper reaches.

WITNESS NO. 49.—MR. JWALA PRASAD, Collector of Etah.

Mr. Jwala Prasad.

15th Dec. 02.

1. *Q.* (*The President.*)—You are Collector of Etah?—Yes, at present I am, but I have only been there about 15 days. I was five years at Jalaun in Bundelkhand before that.

2. *Q.* You were there during the famine time?—Just after the famine. I was at Karwi in the famine time as Joint Magistrate.

3. *Q.* You must have seen a good deal of the Betwa canal?—Of course, because Jalaun is the principal district watered by the Betwa canal.

4. *Q.* What is your opinion of the Betwa canal for that district? Do you consider it a work of usefulness?—Very useful, but unfortunately the water is not enough; that is the only complaint.

5. *Q.* It is thoroughly appreciated then by the people?—Very much so.

6. *Q.* I remember in old days before the Betwa canal was made it was said that the people would not take water?—All sorts of theories are prevalent till canal water is actually available.

7. *Q.* We have heard the question raised a good deal in Bundelkhand that the canal flows really only in the *rabi*, and that there is not much water in the Betwa or almost none for the early *kharif* and there is no rice irrigation from it?—There is no rice cultivation in the Jalaun district. They have attempted to start a little with the canal water, but that is only insignificant and might easily be left out of calculation.

8. *Q.* Do you think there is any prospect of rice cultivation in the canal?—Not in the Jalaun district, because the soil is not suited to rice cultivation.

9. *Q.* Is there no doubt about that?—It is absolutely certain.

10. *Q.* (*Mr. Muir-Mackenzie.*)—What is your soil, *mar*?—*Mar* and *karbar* and *purwa*. *Mar* predominates; next comes *karbar*.

11. *Q.* (*Sir Thomas Higham.*)—Neither of them is fit for rice?—No.

12. *Q.* (*The President.*)—There is some rice cultivation in various parts of Bundelkhand on the borders of the tanks?—I confine my remarks to the Jalaun district, because in Banda there is rice cultivation and that is also Bundelkhand.

13. *Q.* You are satisfied that is so, because the soil is different?—Absolutely so.

14. *Q.* I understand that just now there is almost no water in the Betwa canal in the month of May for early *kharif*. Do you think, if there was a supply of water there, they would take it for cotton?—I have never seen nor heard of cotton irrigated in Jalaun. They have got wells which could easily irrigate an acre or so of cotton if they wished to do so, but I have never seen that done or heard of it being done.

15. *Q.* Are the cultivators good?—No. The Bundelkhandis are notoriously lazy and useless as cultivators.

16. *Q.* Are there any of these *talabs* in Jalaun?—No, it is a place without tanks excepting artificial excavations. It is absolutely flat *mar* soil.

17. *Q.* The *mar* soil we discovered in the Betwa canal is not $\frac{1}{4}$ of the whole?—I could not tell you with regard to the whole canal, but I can tell you that they purposely avoid irrigating *mar* soil. Consequently, of course, it does not serve *mar* soil.

18. *Q.* But last year about 20 per cent. of the irrigation in the canal was done upon *mar*?—Very probably.

19. *Q.* Is there much well irrigation?—Not much. Only a small area is under well irrigation.

20. *Q.* Supposing there was to be a famine in Bundelkhand and in Jalaun again, would the districts be better fitted to stand it than they were last time?—Owing to what reasons?

21. *Q.* Are there any reasons? Is there any protection afforded to Jalaun which did not exist in 1896-97?—No, I don't think there has been any change, except that the revenue has been made easier; Rs. 1,23,000 and odd were remitted by Government this last season; that will give the cultivators some stamina.

22. *Q.* Out of about how much was this remitted?—Rs. 9,81,000 and something.

23. *Q.* That is about a quarter?—Yes.

24. *Q.* But that does not bring more food into the country?—No.

25. *Q.* What measures can one take to improve that state of affairs in Jalaun? Can wells be encouraged?—*Mar* soil is not suited to wells. Of course there is a good deal of soil which is not *mar*, where wells might be made, but the expenditure would be very great. There are certain parts of *purwa* where you can make a well for about Rs. 300; in the other parts it costs about Rs. 800 to Rs. 1,000 and then the good done by that well is not commensurate with the initial outlay.

26 *Q.* Is the water very deep?—Yes, comparatively.

27. *Q.* Do the people apply for *takavi* advances much?—Yes.

28. *Q.* Were you in the habit of giving it to them?—Whenever I could safely, but the outstandings were so heavy that all my energies were taken up in getting them in owing to the lavish bounties given in the famine time.

29. *Q* (*The President.*)—Does the habit exist in Jalaun of bunding round the fields?—Yes, especially in *kans* infected plots where they want the roots to rot out. That is a common Bundelkhand practice. I know two districts in Bundelkhand—Banda and Jalaun—and in both these places they have this system.

30. *Q* And do they use it also for soaking the soil? I suppose the effect is that it raises the spring level of the wells?—Generally I have seen this done only in *mar* soil and as I have said they don't have many wells in *mar* soil.

31. *Q.* They make the *bunds* in *mar* soil?—Yes, mostly in *mar* and *kankar*.

32. *Q.* (*Mr Muir-Mackenzie.*)—*Kankar* is a sandy soil?—No, it is an inferior sort of *mar* in which the calcareous deposit predominates with a little of *kankar* in it.

33. *Q.* (*The President*)—The famine was very severe in Jalaun?—Yes. It was worst in the district I was in—Banda.

34. *Q.* What you say is very sad. Can the people not be induced to take to wells? Is there no policy that could be adopted for protecting these districts from famine? The Betwa canal does not go very far?—I think they intended putting up two extra reservoirs in the Betwa canal. That would mean a good deal of water and in the Paricha reservoir they have raised the storage capacity; that is something; but, seriously speaking, I could not tell you of any plan. If there is timely rain, the crops are good, but if there is one single failure, it is all over for the time being.

35. *Q.* You have suggested one method of protecting these districts by increasing the storage of water in the Betwa?—Yes. Every ounce of water—more that can be had—would be productive of good. That is all I can suggest.

36. *Q.* (*Mr. Roberts*)—As regards the elimination of *kans*, is there nothing that can be done for that?—I have not up to the present known of any feasible method of eradicating *kans*. Where there are hundreds and hundreds of acres in each village which are under *kans*, I don't quite see how bunding or flooding can be resorted to. The *kans* cycle takes 14 to 20 years to disappear, but, of course, the *kans* takes to fresh lands. It is said that the *kans* cycle in Jalaun is coming to a close and the end is expected to occur in another four or five years.

37. *Q.* (*Sir Thomas Higham.*)—How long is it since you left the Jalaun district?—The 17th of last November.

38. *Q.* You say none of the soil in the Jalaun district is fit for rice cultivation?—No.

39. *Q.* Do you say that simply because there has been no rice cultivation?—There never has been any, and the Canal Department has tried to encourage it, but without any success, within the last seven or eight years.

40. *Q.* What have they done to encourage it?—They have given a liberal supply of water to the experimental plots along the canal, but they have never succeeded.

41. *Q.* But rice is grown in *mar* in other districts?—I don't know; I am only talking of Jalaun; there it does not seem to succeed. In Banda they don't grow rice in *mar*; they grow it in a soil, which is a sort of clay which settles near the hill tracts. In Kurwi sub-division I have never seen rice in *mar*.

42. *Q.* Are the holdings very large in Jalaun?—No.

43. *Q.* What size about?—For an average tenant I should say 10 to 12 *bighas*, not more than that. Most tenants have not more than a pair of bullocks and they cannot manage more than 10 or 12 *pakka bighas*.

44. *Q.* They go in for *kharif* crops mostly there?—No. Gram is the principal *rabi* crop. *Kharif* was not such a popular crop before the famine, but since the famine it is becoming very popular in Jalaun.

45. *Q.* You say *mar* won't take water at all?—It will take water, but in fact it will take too much. There are cracks there and you don't know where you are once you let water into *mar* fields.

46. *Q.* Since the famine there appears to have been a gradual increase in the area of *mar* and *karbar* soil which has taken water. Are you aware of that?—No, I could not say if *mar* has increased, because they don't generally encourage irrigation in *mar*.

47. *Q.* These are the figures we have had given us (shown), and you say in the famine of 1896-97 they went up to 17,000 acres in a dry year?—Yes, but that is special.

48. *Q.* Take the areas since then compared with the areas before. Does that mean that the people are gradually taking to irrigation?—Of course they are. There is great trouble in satisfying all demands every year; everybody wants water.

49. *Q.* (*Mr. Muir-Mackenzie.*)—Do they want the water for the *mar*?—They would want water for the *mar* but it is not given and canal officers are very reluctant about giving any water for the *mar*. The Canal Department refused to put in a fresh *rajbaha* because they said that *rajbaha* would only serve *mar*.

50. *Q.* (*The President.*)—I suppose the reason is the great waste of water?—Yes, it is a terrible waste.

51. *Q.* (*Sir Thomas Higham.*)—These *bunds* we have been speaking about are very useful for the extirpation of *kans*?—That is what is said, but I have no practical experience of it. All the *kans* on the surface is destroyed, but whether the root is destroyed I am not prepared to say.

52. *Q.* (*Mr. Muir-Mackenzie.*)—Did you give out much money for making these *bunds* for the extirpation of *kans*?—There were circular orders to the effect that this was not to be regarded in the light of local improvements and, consequently, we could not give *takavi* for that.

53. *Q.* What is your own opinion about the matter? Would you have liked to give advances for that?—No, because I am not certain that they do extirpate *kans*.

54. *Q.* (*Mr. Roberts.*)—When was the order you are talking about issued?—About four years ago.

55. *Q.* Do you know on what grounds?—In Banda and Jalaun district orders were issued that no money was to be provided for this, because they were not really improvements at all. (Witness promised to send in grounds to Mr. Roberts.)

56. *Q.* (*Mr. Muir-Mackenzie.*)—For what purposes of land improvement do you give *takavi*?—For the ordinary purposes, for the making of *bunds* occasionally, but mostly for wells.

57. *Q.* Jalaun in the census of 1901 showed an increase of population?—Yes, 3,000 and odd.

58. *Q.* While the neighbouring districts showed very material deterioration?—There were very special reasons for this. There were two survey parties in the district just about the time of census.

59. *Q.* That might mean a slight increase in Jalaun, but why this decrease of 10 per cent. in the other one?—There were extra causes which threw suppply of men into the district just about the census time.

60. *Q.* The survey party would account for an increase of 3,000, but there was a decrease of 10 per cent. in the neighbouring district. That would require a difference of many more thousands to be accounted for? What is the population of Jalaun?—It was 396,000 and odd.

Mr. Jwala Prasad.

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61. *Q.* (*Mr. Roberts.*)—You have got to account for 50,000 people. How do you account for that?—There were several causes at work, because you see, in the first place, it is a sparsely populated district and in the months of February and March whole gangs came in from Rajputana for cutting the *rabi* crops. In each village there are 50 or 100 persons.

62. *Q.* At any rate we cannot suppose the irrigation helped very much?—No, absolutely not. Out of five lakhs of total area under cultivation, only two lakhs are commanded.

63. *Q.* (*Mr. Rajaratna Mudaliar.*)—How much of that is irrigated?—I could not give you the statistics.

64. *Q.* (*Mr. Roberts.*)—You have been for the last four years in Jalaun?—Five years.

65. *Q.* Loans given for land improvement, which I suppose means wells, are very small?—Very small compared to the other, because I had loans transferred from this to seed and cattle.

66. *Q.* Even then it is very small?—I had to keep to the allotment of the district.

67. *Q.* You never spent the whole allotment; did you?—I was afraid to, because the reason was this, I had very heavy outstandings, both of revenue and *takavi*, against the people.

68. *Q.* Could you not have got more money by asking for it, if you wanted to?—Yes, when I took charge of the district it was not advisable to give large loans, because there were very heavy arrears.

69. *Q.* As a matter of fact, you did not apply for increased allotment?—I dared not.

70. *Q.* And not because you could not get the money?—No.

71. *Q.* Your allotments in the famine were enormous?—Yes, both in Banda and Jalaun.

72. *Q.* Is there any great scope for the extension of well irrigation in Jalaun?—No, because as I say the soil is not adapted to the building of wells. I mean to say there are very few wells in existence except in certain parts where they dig *kachcha* wells.

73. *Q.* Then you don't think anything very much is to be done by the pushing of *takavi* for wells?—Not in the Jalaun district.

74. *Q.* There is a great quantity of grazing in Jalaun?—There is.

75. *Q.* What are the grazing grounds, simply waste lands on which there is no cultivation?—Yes.

76. *Q.* The cattle suffered much in the famine too?—Yes.

77. *Q.* Is there nothing to be done to prevent that recurring?—This was the subject of separate reference whether pastures could be started, but in the case of drought I don't quite see how you could grow grass when there is no water to grow the crops.

78. *Q.* Would tanks for villages be any use?—Yes, but the soil is such that in the last famine when they excavated many tanks hardly 3 per cent. of them held water.

79. *Q.* Then the tanks made in the famine are not of much use?—Absolutely useless. They only held water a month or two during the rains and a month or two after.

80. *Q.* Are they not of indirect use in the keeping up of the supply of water in the wells?—The water only lasts such a short time in them that they cannot benefit the wells in that way. In the hot season, if there was any water in them, they would certainly increase the supply in the wells. At present, supposing the rain water does not evaporate, they are tanks, otherwise they are mere hollows in the ground.

WITNESS No. 50.—MR. F. J. NORMAN, Calcutta.

Mr. F. J. Norman.

15 Dec. 02.

1. *Q.* (*The President.*)—You have sent us your report and we will be glad to hear more about the system you have got, what it costs?—I have put all that in the report there. The ordinary irrigation well as used in Japan is about 300 feet deep; that is with this Kazusa system. Where too many of these 300 feet wells are together, the Japanese put wells down to 480 feet strata, and very very seldom to the 720 feet strata; but 300 feet is about the average depth of irrigation wells in the Kazusa valley.

2. *Q.* What is the soil?—It consists of sand, clay, decomposed granite and occasionally layers of pebbles.

3. *Q.* And the spring level is not reached until you get down to that?—The first spring is at 300 feet. Of course this is not all over Japan; it is only where Kazusa wells are sunk. After my report was written and had been discussed in the Japanese newspapers, a paper manufacturer in the suburbs of Tokyio came to me and asked me about this system, and he put a bore down to 800 feet before striking water.

4. *Q.* What is this valley like?—There is a high range of hills lying back of it, 12 to 20 miles from the sea, and then and along Tokyio Bay the land has been reclaimed for

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two miles out seawards. Kazusa style wells are even sunk in this reclaimed land which about four years ago was sea. The highest point in these hills is Mount Tsukuba, which is 2,925 feet high.

5. *Q.* Is there anything difference about the place to the country in general?—All around Chiba the country is more undulating than hilly, while in other parts of Japan the land is more hilly than undulating.

6. *Q.* Then the Kazusa system originally came over from China? -Yes, or at any rate a system very much like it. Abbi Hué's book on China gives a short account of the Sychuan system. In my report I say that trial borings have been made up to 1,200 feet, but since that report was written, 1,400 feet were bored in another province, in Echigo where the oil fields are. There the soil is disintegrated granite with solid boulders interspersed. When they struck one of these boulders it was very slow work.

7. *Q.* Is this system used then for boring for oil just as well as for boring for water?—Yes. An American Missionary, who was up in Echigo some 18 or 20 years ago and knew something about oil, told the Japanese that there was oil there. A Japanese syndicate was formed and took some of these Kazusa men to Echigo who put down trial borings for oil. In the meantime the thing was a good deal talked about and the Government then employed an American expert with American machinery, and now Echigo is a great oil field. In fact the Standard Oil Company, under the name of the International Oil Company, has stepped in.

8. *Q.* Is this system being practised as well in China?—It is still going on there now. I have not seen it myself, but I was told that it was so the other day by a man in the China customs, and also by an American Missionary.

9. *Q.* In the Kazusa valley are there special surroundings there which differentiate it from the country in general? – I should not think so. They have tried the Kazusa system in Tokyio which is 22 miles away and struck water.

10. *Q.* I suppose there is some irrigation in Japan?—A very great deal.

11. *Q.* Have you seen irrigation wells of this description?—Hundreds of them, all round Chiba.

12. *Q.* Is there a considerable area commanded or watered by these wells?—I have no idea what area is watered by such wells, but it is something considerable—hundreds of thousands of acres. I tried to get statistics from the Japanese authorities, but failed. In my report I say from two to five acres. That is a very big area for one well; I should have put it down at from 1½ acres to three acres per well.

13. *Q.* You have been some little time in India and have seen the style of country we have around us here. There is rock all through and when you go down from 20 to 80 feet you are sure to find water. Do you consider that is the sort of country where this system could fairly be tried?—I see from the geological report here of a well having been put down in Agra and that the water came up within 20 to 30 feet of the surface. I don't see why that very costly well that was put down here by European methods could not have been put down by the Kazusa system. I would not like to say how much cheaper the Kazusa method would be, but I know that Burn & Co. of Howrah would turn out the whole plant required for Rs. 200 to Rs. 300, while the plant that sunk the well here must have cost landed in Calcutta £800 at the very least. Besides that you have had to pay for the enormous costly piping, while the Japanese use bamboo piping. Since I have been here I have had long talks with Major Prain, Superintendent of the Botanical Gardens at Sibpur, and have been comparing the bamboos of this country with those of Japan and I have found this bamboo (shown) which is an Indian bamboo is similar to the Japanese one, which is 2½, 3 and up to 4 inches internal diameter. This is a very fine bamboo and you get it in any quantity in Sylhet and Assam. There is one thing, however, I must tell you, and that is that bamboos are cultivated in Japan, whereas the Indian bamboos are allowed to grow wild in the jungles. When I was in Calcutta, I went down to Balliaghatta which I was given to understand was the great mart for bamboos, and there I picked this one (shown) out of a large number, and it reminds me in every way of the Japanese bamboo.

14. *Q.* (*Sir Thomes Higham.*)—What will the inside diameter of this work out to?—Two'and half a inches.

15. *Q.* You say these wells are sunk in only one particular province in Japan?—That is so at present. It has not been known elsewhere. It was by a mere fluke that I found out this system. I had been over the district time after time snipe-shooting, and I must have passed such wells hundreds of times, but I never took any notice of them till about two years ago when I went down and lived near Chiba, and then I noticed them and made enquiries regarding them.

16. *Q.* Why is it they have not been used anywhere else?—Because they have not been known sufficiently. Until quite recently, within the last 25 years, the communications in Japan were very bad indeed and then the feudal system was in vogue. The different feudal lords were very jealous of each other, and if one of them got hold of a good thing like this Kazusa system, they would not allow their neighbours to know anything about it. The Japanese are a very suspicious and secretive people, and although they learn all they can from other nations, they don't like to impart any information to others. At first I could get nothing out of them about the Kazusa system, and the native whom I employed to assist me in my enquiries had a great deal of trouble with the native officials until I went to the latter and told them that if this sort of obstruction continued I would put the whole thing in the papers and bring it to the notice of the higher authorities, and then my troubles ceased.

17. *Q.* Wherever these wells are sunk you have artesian conditions?--More or less. Wherever a 720 feet stratum is struck, you will find the water rising four inches to a foot above ground.

18. *Q.* Are there not many wells where the water rises, but not up to the surface?—There are, but they are generally very old wells.

19. *Q.* When a well is first made the water does rise to the surface?—Sometimes not, but when this happens the well-sinker uses one of the tools which I have described in my report, and which they call "the coaxer"; it is used for clearing the pipe and for pumping up the water. You see the water sometimes remains 20 or 30 feet below the surface, and they work it up higher and higher day by day until it flows over the top of the pipe.

20. *Q.* Do they never put wells down and fail to get the water?—Yes, at times they do, but not often in the Kazusa valley. I don't know what the conditions would be in other parts of Japan. I only know that in Kazusa and around Chiba these wells are to be met with in hundreds.

21. *Q.* There must be strong artesian conditions for it?—Yes.

22. *Q.* What is the diameter of these tubes they put down?—Their bamboos are smaller than the Indian bamboo. I should say the inside diameter of their wells on an average is not more than 2 inches; 2 inches would be a fairly big well.

23. *Q.* You say they put down these wells and pay only when they find the water?—Yes. Generally say no water, no pay. That is the system they go upon.

24. *Q.* They always do find water?—Yes. These well-sinkers live in the valley and they know the district thoroughly well and can tell you whether they will find water or not in a place.

25. *Q.* How do they pay; according to the depth gone down?—Three hundred feet wells cost from 27 yen to 30 yen, *i. e.*, from £2-14 to £3. A yen, we will say, is 2 shillings.

26. *Q.* Do they pay by the foot?—No. It is simply by the well.

27. *Q.* What do they charge for a 720 feet well?—From £8 to £10. Of course that is purely the well-sinking work; the coping and kerb go into another account.

28. *Q.* Do you suppose these men can sink wells at anything like those rates in India?—I think they would have little trouble. You would have to leave a man in Calcutta or wherever you have your bamboos to pick your bamboo. The bamboos here are not very straight; at least very few of them grow straight here, but they might be cultivated to grow straight here as they are in Japan. I explained to Major Prain of the Botanical Gardens at Shibpur how they were cultivated in Japan, and he was of opinion that there was nothing to prevent the same thing being done here.

29. *Q.* About what length are the bamboos they put down in Japan?—The full length of the bamboos up to taper point would be about 40 to 50 feet in Japan, but each section of piping is about 12 feet; in fact they are anything from 10 to 16 feet, but 12 feet is about the average, and then they join on in this way (illustrates.)

30. *Q.* Supposing you were able to get the bamboos there is no other reason why wells should cost more to sink in India than in Japan?—No. You would teach the natives how to do it. There is only one skilled man required. "the boss," who sits over the well and directs operations. He must be more than an ordinary intelligent coolie; the other men are simply coolies who do the lifting and letting down of tools in the bore-hole.

31. *Q.* There is only one man who really knows anything about it?—Yes.

32. *Q.* What does he get paid?—He takes a contract. The income of the man in Japan with whom I worked up the system is not more than 12 to 15 yen or 24 to 30 shillings a month; that is what his profits come to.

33. *Q.* (*The President.*)—I suppose labour is cheaper in Japan than it is in India?—It is cheaper ~~in~~ the sense that it is more intelligent labour. The *saki* as you ~~may~~ know is the national drink of the Japanese, and for the manufacture of it the purest water is required. Therefore the factories where it is manufactured, and which are situated away in the mountainous districts, have to get the water above the line of cultivation, and instead of using iron pipes to convey the water to the factories they use bamboo pipes, and I have myself known of a case where water has been brought 18 miles in pipes like that.

34. *Q.* (*Mr. Roberts.*)—How do they get round the corners?—They make joints from cubes of wood (illustrates his meaning.) And I have heard from the Japanese themselves; and I have every reason to suppose they were telling me the truth; these pipes will last under ground for 10 or 20 years. They lay them—should it be deemed necessary—from two to three feet under ground, and surround the pipes with a layer of ashes 2 to 3 inches deep. This last is done in order to protect them from the attacks of worms, etc.

35 *Q* (*Sir Thomas Higham.*)—You have come to India now for the purpose of developing this system? Yes. I did so because certain negotiations I had been carrying on with the Russian authorities in Port Arthur—with a view to the introduction of the Kazusa system there—miscarried.

36. *Q* These places where your system is tried are places only where the geological configurations are favourable to artesian wells. You would not expect it to succeed in great alluvial plains like the Ganges delta?—There are artesian configurations there too, and I don't see why experiments should not be made. It is not only for that, but supposing a native wants to put down a *pakka* well, he finds it not only a very expensive undertåking, but moreover a risky one, for he does so more or less without possessing data as to the sub-oil, etc. Why not have this system introduced into India for testing strata. It would be useful for trial borings or for increasing the supply in existing wells. Then again the system is so simple that the whole of the machinery could not only be made by an Indian *mistri*, but could be kept in order quite easily by villagers. There is such little intelligence required to work the system, and the simplicity and cheapness of the whole thing should appeal to everyone.

37 *Q.* You would have to bring your bamboos out from Japan?—This bamboo (shown) as I have already said is Indian and is the same as the Japanese bamboo. Of course for the first few years you would have to pick and choose your bamboos here, but then you could cultivate them later on and have bamboo plantations as the Japanese do in Kazusa.

38. *Q.* Would you be willing to undertake boring in India at contract rates?—Until I know the strata I have to tackle I would not take any contract.

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39. *Q.* You would not take any risk?—No.

40. *Q.* You would not work on the system—"no water, no pay?"—I don't know the conditions here, but what I do know is that the thing is very simple, and I cannot see why it should not be introduced into India.

41. *Q.* Supposing they have to go through very light sandy soil?—I had one of the best American experts ask me about this very same thing. I have told you how they go through the process. They first of all choose the spot that the bore hole has to be taken down. They then dig down the hole 6 or 8 feet deep and into this they insert a cylinder of wood, iron or sometimes of very big bamboo; a foot and a quarter of that cylinder will be above ground; and 6 or 7 feet under ground. Around that cylinder is a tube. Then they erect a scaffolding around and over it, and while they are boring, a boy in attendance is kept busily at work pouring down the bore-hole water with lots of clay dissolved in it. In sandy soil or any other soil, this clay ~~not~~ only acts as a lubricant for the tools, but by depositing itself ~~on the~~ sides of the well braces them up. The wells go down 300 feet ~~or more~~ without tubing, and after striking water the bamboo piping ~~is put~~ down joint by joint. The operation is not a lengthy one, and ~~after~~ time the clay settles down and forms a well round these bamboos and preserves them.

42. *Q.* (*Mr. Muir-Mackenzie.*)—Would this do just as well for rock?—The Japanese told me that in this Echigo trial boring for oil, 800 feet out of the 1,200 feet they went through was rock. I only go on their report for this, but when I put down a 300 feet well myself I struck a stratum of pebbles, some 20 feet under ground, some of which must have been very large. At 80 feet below the surface I struck a stratum of stones, which was very hard, and at 180 feet we struck disintegrated granite, after which we struck the water level. It would go through *kankar* very very easily.

43. *Q.* How long does it take to put down a well?—Ten days to a fortnight. I have put one down in 11 days; that was the first time.

44 *Q.* What is it you would like the Government of India to do?—To give me a contract to form a school for the introduction of this system and to place some men under me for instruction.

45. *Q.* (*The President.*)—Have you made any proposition to the Government of India?—Yes, but I have received no decided answer as yet.

46. *Q.* Would you be prepared to give your services to Government for one or two months?—Yes, if I am given a contract. My idea would be to bring over a couple of Japanese to do the mechanical part of the work and show the natives of India the system. One of the Public Works Engineers might be deputed to report on the system, and if he reported favourably, the school could be formed.

47. *Q.* Do I understand that your proposal is that, assuming that you have your instruments ready, you would erect machinery and carry out a boring at some place to be agreed upon for a certain salary while this work was going on, that after a certain time, supposing you satisfy the authorities here that your system is a good one, you should be put in charge of an undertaking to teach the natives of India the system for a period to be settled?—Yes, that is exactly it.

48. *Q.* You have not made a proposal to the Government of India?—Not quite on the lines just indicated.

49. *Q.* When would you be ready to commence works?—At the commencement of the coming year.

TWENTY-SEVENTH DAY.

Agra, 16th December 1902.

WITNESS No. 51.—MR. G. E. COLES, Superintending Engineer, 2nd Circle, Irrigation Works, Agra.

(Replies to printed questions.)

Mr. G. E. Coles.

16th Dec. 02.

A.—GENERAL.

1. Chiefly districts in the Agra and Allahabad Revenue Divisions, and the country embraced in the 2nd Circle of Superintendence, Irrigation Branch, Public Works Department. Undersigned as Assistant, Executive, and Superintending Engineer has passed most of his service in this Circle. In more northern divisions he has served in various capacities, in the 1st Circle and in the 3rd Circle, in the Agra Canal, the Northern Division and Bulandshahr

Mr. G. E. Coles.

16th Dec. 02.

Division, Ganges Canal and on the Rohilkhand Canals (3½ years).

2. During the five years, from 1896-97 to 1900-01—

Narora Division	26·7 inches.
Mainpuri Division	27·8 do.
Cawnpore Division	30·6 do.
Etawah Division	28·9 do.
Bhognipur Division	28·6 do.

Average for whole of 2nd Circle, 28 5 inches.

3.

(1) No.

(2) No.

(3) Supply is sufficient, as a rule, for superior crops such as sugar, garden produce, opium, tobacco, but insufficient for wheat and cotton: this, however, is not an obstacle to extension of irrigation.

(4) No black cotton soil, but in some parts where there is much *usar*, irrigation is inadvisable.

(5) The supply of water usually sufficient, but at times the *rabi* supply falls very low, and it is all one can do to maintain existing irrigation.

In 1899-1900 the river Ganges in January could supply 5,000 cusecs only, or 2,500 cusecs only for each of the 1st and 2nd Circles.

(6)

(7)

(8)

(9) The only obstacle that has come forcibly to my notice, to the extension of canal irrigation, is the fear of raising the spring level to an undue height. As an example of this I may cite the case of a project for extending irrigation in the Aliganj tahsil of the Etah district. On examination of the country it was found that even in a dry year like 1899-1900 the spring level in the tract was high (8 ft. to 15 ft.) and that the introduction of canal water to the tract would probably be the reverse of beneficial. The irrigation in the villages of this tract is from percolation wells generally, and a very fair area is irrigated from such wells in the vicinity of villages; but the greater part of the tract is unirrigated.

4.

5.

6. Not as far as I am aware of.

The Circle, now that the Fatehpur Branch has been made, is very well provided with canal irrigation on the whole, and I do not think any large extension is possible, though there are some small areas which may be taken up. From time to time applications are received from people in the districts, and receive attention, and where possible a distributary or minor taken out from existing canals or branches.

The only sources of supply still untapped in these provinces are the Ramganga, Sarda Deoha and Ken and other small Bundelkhand streams. For the latter projects are being prepared.

B.—CANALS OF CONTINUOUS FLOW.

7.

(1) The percentage of the total area irrigated in the 2nd Circle which is double cropped is 21 per cent. Most of this area is *kharif* cultivated in *rabi*. The percentage of double-cropped area is 75 per cent. of the *kharif* area irrigated. This does not mean of course that ¾ of the *kharif* area is double cropped, but properly 60 per cent. is.

(2) The substitution of more for less valuable crops naturally follows irrigation from canals of continuous flow. On the Fatehpur Branch, which has only been open for three years, already sugarcane is increasing, and wheat is rapidly being substituted for *bijri* (*bejhar*), gram and such like inferior crops.

(3)

(*a*) In a year of ample rainfall the increase in the yield is not so marked as one would expect in a canal irrigated area, and this is probably due to the fact that heavy rain on an already irrigated crop develops it too quickly and makes it run to stalk. Accompanied with much cloud ample rainfall is apt to produce rust, smut, and other diseases.

(*b*) In a year of scanty rainfall irrigation most undoubtedly increases the yield, as in the absence of much rain the cultivator can regulate to a nicety the quantity of water he should take to give him a bumper crop, and is free from the evils of a year like (*a*).

(*c*) In a year of drought crops which are irrigated from *paleo* to final watering should give a full yield, provided that a sufficiency of water can be got from the canal throughout the *fasl*. Those which have been sown without *paleo* or for some cause or another have been unable to get waterings in full, or at times which are not exactly suitable, will not give a full yield.

8.

(1) The indirect revenue credited to the Lower Ganges Canal is Rs. 2,09,586 annually.

The estimated value of crops irrigated and estimated value per acre for four years from 1896-97 to 1899-1900 is as follows:—

	Total value.	Value per acre.	
	Rs.	Rs.	
1896-97 .	3,86,84,543	37·1	Drought year.
1897-98 .	2,30,91,917	26·7	Ordinary years.
1898-99 .	1,86,52,231	26·5	
1899-1900 .	2,54,79,510	34·2	

(2) Value of crops, 1896-97, Rs. 37·1 per acre, which is 8 above average value (29·1) in the three ordinary years shown above.

9.

(1) Circle occupier's rate { *Rabi* Rs. 3·11 per acre.
Kharif Rs. 2·38 ditto.

Taken on an average of five years from 1896-97 to 1900-01.

(2) On Fatehpur Branch where rates are higher the average occupier's rate would be about ¼th higher.

(3) Owner's rate realized works out to about $\frac{1}{10}$th to $\frac{1}{12}$th of the occupier's rate.

10. Private expenditure is incurred in making and repairing *guls*, making *kiaris*, lifting water, and in laying it on.

The cultivator, as a rule, does all this at his own expense; but I believe some zamindars aid in making *guls* and keeping them in repair; this is, however, exceptional. I am not aware that the tenant has any security for recoupment.

On the Rohilkhand Canals the zamindar takes so much per plough per *fasl*; 4 annas, if I recollect correctly, for repairing *guls*, but he doesn't always carry out this part of his contract.

11. There is no doubt that the soil would yield heavier crops if more manure were used on crops irrigated from canals. The quantity of manure required is not available. There is, however, always a small amount of manure added to the soil yearly from decaying vegetation, such as stubble, grass, weeds, and leaves, etc.

Again the silt and vegetable matter in canal water acts in many cases as fertilizing matter. It is for this reason then that it is possible for fields year after year to bear a crop which gives what has come to be known as an average yield. I do not think therefore that much damage has resulted to the people, nor has the soil so deteriorated in canal irrigation districts as to become unfit for cultivation except in isolated cases.

As an isolated case I may mention that of the Farrukhabad Branch, Lower Ganges Canal. There is no doubt that in the early days of the Branch it did suffer from water-logging, due chiefly to excessive rainfall, but partially to the introduction of canal water without sufficient drainage. Since large drains have been made and natural drainage lines have been improved, the condition of the land on this Branch has quite changed. People have returned to their villages, new land has been broken up, and irrigation is resorted to as freely as on other divisions of the Lower Ganges Canal. The old state of things can, humanly speaking, never occur again, for in addition to an effective drainage system, the branch runs in alternate weeks only, and the cultivators are learning so to economise water, and to carry out their irrigation promptly, that it is almost impossible to over-irrigate, and yet the old irrigation is well maintained, and in some years extended.

It has been the object of the canal authorities in the past few years to thoroughly guard against water-logging by running irrigating channels in alternate weeks. In the 2nd Circle out of six* branches three run almost strictly alternately, and the other three branches continuously, but the distributaries in the Cawnpore and Fatehpur run mostly alternately, whilst Bhognipur generally run two weeks in three. It is impossible, at any rate at present, to run the Cawnpore and Fatehpur alternately, but Bhognipur, with but little alteration, can and will be very shortly. With regard to salt efflorescence, I do not think it is anywhere increasing, though I cannot say it has diminished, except in a few isolated places, where I observed more grass grow than was formerly the case. I cannot call to my mind any appreciable sized tracts where cultivation is possible in what was formerly *usar*.

The results of draining irrigated land are very beneficial, and those obtained in the Bulandshahr Division, Ganges Canal, and Farrukhabad Division, Lower Ganges Canal, are very marked. At the same time there is a limit, and I think that we should stop short of drainage to the extent which might adversely affect fodder supply and storage in village ponds.

In the 2nd Circle the need for drainage on a scale which is required in the 1st Circle is not felt. The rainfall is less and the climate is hotter. I think the soil is more absorbent, and there are fewer hollows and chains of hollows where water accumulates. The doabs are very narrow, and excess in sub-soil water temporarily raised during the monsoon, drains after the rains rapidly to the bounding *naddis* before they have dried up entirely.

C.—CANALS OF INTERMITTENT FLOW.

12. With exception of one or two very small ones on the Rohilkhand Canals, I have had little experience of such canals, and I therefore abstain from answering the questions.

D.—OF TANKS.

I have had no experience.

E.—WELLS.

Average depths to spring level.	Cawnpore	Division	22
	Etawah	do.	21
	Bhognipur	do.	42
	Mainpuri	do.	17
	Narora	do.	17
	Fatehpur	do.	40

Beyond giving the average depth of water below ground surface in the various divisions of this circle, I am unable to give any reliable information with regard to wells, as my personal experience of them and their working is limited, and Revenue Officers other than Irrigation would be able to give more accurate information on the subject.

Report, dated 18th September 1902, on Extension of Irrigation on the Lower Ganges Canal into Minor Doabs.

There is but little scope for extensions of any size in the Lower Ganges Canal system, all the doabs of any importance being each taken up by their respective branch canals.

2. It will be as well to enumerate these.

Narora Division, Farrukhabad Branch, between the Ganges and Kali Nadi.

Mainpuri Division, Bewar Branch, between the Kali Nadi and the Isan.

Mainpuri Division, Cawnpore Branch (part), between the Isan Nadi and the Rind.

Etawah Division, Etawah Branch, between the Rind Nadi and the Sengar.

Bhognipur Division, Bhognipur Branch, between the Sengar and Sirsa Nadis and the Jumna.

Cawnpore Division, Cawnpore Branch, between the Isan Nadi and Ganges and the Rind-Pandu.

3. The doabs are narrow, and the canal water reaches generally to the bounding rivers except where large *usar*, or lowlying drainage tracts intervene.

4. There is a large amount of *usar* in the circle,* a broad backbone of it running right down the centre between Cawnpore and Etah on to Aligarh, the axis taking roughly an east and west direction. It is not continuous and there are some extremely fertile tracts of larger or smaller extent.

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5. The doabs of the Farrukhabad and Bhognipur Branches are practically free from *usar* except a little in their upper miles

6. The result is that in those divisions, where this scourge of the land exists, the irrigation must be somewhat scattered, and it is in many instances necessary, for the distributaries for parts of their lengths, to pass through *usar* in order to deliver water to the more fertile tracts.

7. I will now take each division and see what possibilities there are of extension in their respective doabs.

8. Narora Division. The Farrukhabad Branch.

A proposed extension into the Aliganj pargana of the Etah district, taking off from mile 36, to water the tract between the Branch and the Kali, has lately been investigated. A careful survey and reconnaissance of the country was made by Mr. Wilkins, Assistant Engineer. Mr. Mackenzie and myself went all over the country, but finding that the spring level in wells even in a dry year stood from 8′ to 15′ from ground surface, the Chief Engineer ordered the abandonment of the project. The late Colonel Ross, R.E., debarred this area 30 years ago as unsuitable for irrigation.

The irrigation in the tract is chiefly from percolation wells while in the portion of it which lies in the Awa Estate there are some good wells which were made under the superintendence of the late Mr. Wilson.

9. The tract round Kaimganj as far as Roshanabad is well protected by wells of a stable character and is also a debarred area; it lies to the north of the Branch and between it and the Ganges, or rather Budh Ganga.

10. The only tract to which any extension remains to be considered is one lying to the south of Farrukhabad between the Bhagar Nala and the Kali Nadi. Its centre is marked by the large village of Mohamadabad on the Fatehgarh-Bewar *pakka* road. I have crossed the country by this road, but was not much struck with its capabilities; there are two tracts of *usar* and lowlying country. Still it is worth investigating. Its length is about 25 miles, with a width (average) of about 17, *i.e.*, 425 square miles. In order to reach it (and this is the only way) a branch would have to be taken off from about mile 60 (practically the tail) of the Branch. This must cross the Bhagar Nala, and would involve an aqueduct, with ample waterway and heavy embankments across the valley of the Bhaga. Except in an extraordinary year of drought with a very low river supply there would be no difficulty in affording the water for it

11. Mainpuri Division, Bewar Branch.

There is no extension possible from this except a moderate sized distributary, to water the country between the Kak and Isan Nadis and a local *nala* called the Chachhena Nala, taking off from above Kuraoli Regulator. I am afraid it would pass through some *usar* before getting at the good land of the tract lying north of the town of Mainpuri. It is worth investigating. Another tract lying in this division which is worth investigating is that lying between the Kak and the Isan. It lies between Sakit and the junction of those two Nadis and is about 20 miles long and 10 to 12 wide.

The only way canal water can reach it is by taking off a channel from the right bank of the Bandi Distributary, which is fed from the Cawnpore stump in the Aligarh Division. It would involve another syphon under the Main Canal and widening of the Isan Nadi aqueduct in order to convey the extra supply.

12. I am quite unacquainted with the tract, but from its position in the centre of the *usar* backbone am afraid the irrigation would be scattered and the channel would pass through *usar* in parts of its course.

13. Etawah Division.

A few small extensions are possible from the Branch, but they are of no great size, hardly larger than minors in many cases.

Mr. Cones, Executive Engineer, Etawah Division, has submitted rough proposals in accordance with Chief Engineer's orders and I am considering them.

The only scheme of any dimensions is that of the Left Palinda Distributary, which is meant to take up the exist-

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* Farrukhabad. | Bhognipur.
Mainpuri. | Cawnpore.
Etawah. | Fatehpur.

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ing direct irrigation from the Branch and will add a few hundred acres. It will water the country between the Branch and the Auhiya Nadi. It has already been submitted for sanction.

14. Bhognipur Division.

With one exception the extensions possible are small distributaries and minors, proposals for which have been submitted to Superintending Engineer. Some of them are of doubtful possibility and utility.

The only scheme of any size is that to extend irrigation to a tract of country lying between the Batesar road, the Jumna ravines, and the Grand Trunk Road through Firozabad.

15. This scheme has been on the tapis for some years, since 1895, and was proposed by Mr. Atkinson, but nothing has been done except reconnaissance and roughly indicating the line on the 1" map.

The area concerned is about 22 thousand acres of cultivated and about a thousand culturable. The land is good, though somewhat *bhur* in parts. The percentage of well irrigation about 25 per cent. So there is plenty of room for canal irrigation which will bring up the irrigated area to 50 per cent. of the whole. The wells are deep as are all wells in the Jumna *bhangar*.

The best place to take off a distributary would be at about miles 17 of the Bhognipur Branch, but it would be difficult to find a suitable line through the sand hills, and moreover an aqueduct would be required across the Sirsa.

Mr. Atkinson's proposal was to take off by a separate head from the Ubhti. I do not think this is necessary. The channel might easily be taken off from the Ubhti itself which would be widened both as to head and channel, and the bridge under the railway would also have to be widened in order to take the extra 40 or 50 cusecs required.

Whether the command is sufficiently good has not been ascertained as yet, but levels will be taken during the ensuing cold weather. I have put up map to illustrate proposal. There is a regulator in Branch below Ubhti Head.

16. Cawnpore Branch.

There is very little room for extension of this Branch. The doabs commanded by it are very well taken up. There is also a very large amount of *usar*, especially in the first sub-division. The construction of a few minors is all that could be done.

17. There is, however, one small doab which might be investigated between the Rind on the south and the Kansua Distributary. The northern portion is already commanded by the Kansua Distributary; the southern portion is the one needing enquiry. The old main line *viâ* Rasulabad and the old Jhinjak Branch feeder to the Etawah Branch were aligned along this tract of country in the first instance.

My recollection of the country traversed by the latter, it having formed part of my first sub-division, is that there was a good deal of *usar* interspersed with better land here and there.

The line which would irrigate this tract would have to take off the Kansua Distributary high up in its 3rd or 4th mile and would have to bifurcate, as there are two marked drainages lower down the doab which would have to be rounded.

The area of the tract is about 20 miles long by 8 broad =160 square miles.

18. Fatehpur Branch.

It is rather too early in the day to suggest any extensions. The branch is developing slowly, but I think surely, and there are still channels to be constructed other than those finished.

19. I have not time to get a sufficiently large scale map made to illustrate my report, but I would be happy to insert the lines on Chief Engineer's one inch maps, if sent to me for the purpose at Jeolikot. It would take but a short time.

Note by G. E. Coles, Esq., Superintending Engineer, 2nd Circle, Irrigation Works, United Provinces of Agra and Oudh, on the duty of water.

Duty.—During the last few years great attention has been given to the question of economising water required for the irrigation of the tracts commanded by the canals in these provinces.

2. The two main factors which have contributed towards effecting the more economical distribution of water are the remodelling of distributaries and the consequent abolition of *tatils.*

On the old Divisions, Cawnpore and Etawah, the distributaries of an earlier age were not always on the best alignments, nor properly graded.

The first to receive attention were those in the former Division, by Captain Hall, whose system of remodelling in the early eighties has practically, with some few alterations, been in force ever since.

On the Etawah, Mr. Marsh, C.I.E., inaugurated a new system of remodelling distributaries and reduction of *kolabas* (which were far in excess of requirements.) His system has been carried on by his successors with the best results.

On the newer Divisions, such as Narora, Mainpuri, and Bhognipur, the distributaries were lined out by a special officer, Captain Ross, R.E., and, except to a minor extent, have not required the more drastic treatment required in the older Divisions. In fact, it has only been necessary in some cases to re-grade and widen out to a limited extent; and, although reductions in outlet power have been carried out, with a view to abolishing *tatils*, they have been small, as the congestion of outlets, such as was found on the distributaries of the older Divisions, has not occurred.

Another, and very potent, factor in economising water has been the running of branches of the main canal in alternate weeks when possible.

The Farrukhabad Branch and the Bewar Branch now run strictly alternately, each with an allotted full supply of 700 cusecs. In the Cawnpore Division, with the exception of two or three distributaries, all others run strictly in alternate weeks. In the Etawah Division the distributaries run alternately: the majority during full supply week, and two or three during the low supply week, when the volume given to the Branch is less than one-third of full supply.

In the Bhognipur Division the distributaries have, as a rule, received full supply for two weeks in three; but in certain years, such as 1899-1900 and in 1901-02, when the available volume in *rabi* for the whole circle dwindled to about half of the full, the distributaries had to be run in alternate weeks, by taking in a little extra water at the head of the Branch.

The principal and most remunerative season on the Lower Ganges Canal is the *rabi*, and, in consequence of the low supplies which the river can give during it, the distribution is most difficult for the winter crops whenever there is any failure or delay of the winter rains.

It will, therefore, be best to see what results have been obtained during the *rabi* of certain years as regards duty.

The year 1896-97 was a famine year, and most fortunately it was a year of very fair supply during the *rabi* season. The utilised supply, 3,900 cusecs, is far in excess of what was available in the years 1899-1900 and 1901-02, when the river supply dwindled down considerably, and the utilised volume for this circle (five old divisions) was 2,522 cusecs and 2,730 cusecs, respectively, during the six months comprised in *rabi*.

In the former year timely winter rains did fall and relieved the strain, but the latter year was almost rainless.

I have taken the utilised volumes during the six *rabi* months and have also included the previous *kharif* sugarcane area in the areas irrigated during *rabi* in the following table, which gives the duties in the Divisions forming this circle for those years.

They work out as follows:—

Table I.	*1896-97.*	*1899-1900.*	*1901-02.*
Narora Division .	173	202	216
Mainpuri „ .	176	235	275
Cawnpore „ .	211	278	159
Etawah „ .	191	180	180
Bhognipur „ .	177	177	211
Average of Circle .	185	214	208
Fatehpur Division .	...	195	181

I am doubtful about the correctness of the Cawnpore figures for 1901-02, and think that some of the supply obtained by Fatehpur has been debited to Cawnpore. The Cawnpore Branch distributaries, if all were running at the same time, would give a mean daily discharge of 914 cusecs. Of the distributaries three run with a constant discharge of

252 cusecs, the rest run an alternate week supplies of 662 cusecs, so that at most the mean discharge utilised should not exceed $\frac{662}{2}$ plus 252 = 583 cusecs.

The area irrigated was 106,357 acres, and the duty, therefore, should be $\frac{106{,}357}{583}$ = 183 acres which, considering what the Cawnpore Division did in 1896-97 and 1899-1900, is likely to be nearer the correct figure.

For a comparison of the supplies utilised during the six *rabi* months in the years I have taken the following table is furnished :—

Table II.	*1896-97.*	*1899-1900.*	*1901-02.*
	Cusecs.	Cusecs.	Cusecs.
Narora Division .	388	343	262
Mainpuri „ .	532	370	309
Cawnpore „ .	670	405	671*
Etawah „ .	1,177	877	991
Bhognipur „ .	797	527	497
TOTAL .	3,846	2,522	2,730
Fatehpur Division .	...	218	324
Total supply utilised .	3,864	2,740	3,054

* As explained above this should be at most 583 cusecs.

The areas irrigated during *rabi* of these years is as follows :—

Table III.	*1896-97.*	*1899-1900.*	*1901-02.*
	Acres.	Acres.	Acres.
Narora Division .	67,062	69,156	56,799
Mainpuri „ .	94,102	87,102	85,117
Cawnpore „ .	141,632	112,591	106,337
Etawah* „ .	225,266	160,042	178,494
Bhognipur „ .	140,874	93,485	104,809
Fatehpur * „ .	...	42,546	58,676
Total area in Circle .	668,908	564,922	590,232

* Includes Ghatampur.

Looking at Table I, we see that in the Narora (*i.e.*, Farrukhabad Branch) and Mainpuri Divisions the duty on discharges utilised in *rabi* have steadily increased; in the Mainpuri Division the increase is remarkable. This I consider due, in a great measure, to the Farrukhabad and Mainpuri or rather Bewar Branches running nearly strictly alternately and to the remodelling of the latter Branch and its distributaries.

The Cawnpore distributaries were remodelled by the late Captain Hall, R.E., in the eighties, and not very much has been done to them since, and that they are efficient channels the duties of *rabi* 1896-97 and 1899-1900 show. The drop in 1901-02 is somewhat unaccountable. As I have shown above I think that the Branch has been debited with water given to Fatehpur. Other reasons are, that a large quantity of rice was irrigated in the months of October and November 1899, and the sugar area is the largest in the Circle, being over 10,000 acres.

Etawah's figures are fairly level, and, considering the scattered areas it has to serve and the large amount of *usar* in parts of the Division, the duty is a good one. It likewise does a good area of rice in October and November, which is not included in its *rabi* area like sugar.

Bhognipur Division figures are likewise good, and the slight remodelling of some of the distributaries during recent years and the necessity for running it as an alternate Branch in *rabi* 1901-02 with a larger supply account for the rise in duty from 177 to 211 acres for every one cusec utilised.

It is too early in its history to say much of Fatehpur Division, which includes the Ghatampur and its extension. The duty figures are so far good, but irrigation has not yet fully developed.

While discussing *rabi* duties of the Lower Ganges Canal a few words require to be said as to two crops which tend to reduce the duty figures on this canal, namely, rice and poppy.

The former is cultivated to the extent of 20,000 to 40,000 acres, and has occasionally exceeded the latter area. A great deal of it, especially in the lower part of the Circle, requires water in October and November. Such area is not included like sugar in the *rabi* area, though requiring very nearly the same amount of water as cane.

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The latter (poppy) is a most troublesome crop to the irrigation officer. It is almost always sown with *paleo*, requires water every 10 to 14 days throughout the *fasl* unless there are extraordinarily good winter rains; and again, after all other *rabi* crops have ceased taking irrigation and harvesting is in progress, it requires final waterings, especially if hot winds set on about middle of March.

The area irrigated in this Circle exceeds 30,000 acres, and it takes as much water as double the area of wheat at a cost of ⅓ more only in water rate; to say nothing of the waste of water entailed in supplying its needs when other crops have ceased to take water.

I hope to have some further details with regard to duty on distributaries prepared by the time I am called to give evidence before the Irrigation Commission in December.

I have said nothing about duties in *kharif*. The *kharif fasl* is second in importance in this Circle, and the duties vary greatly. The loss of the indigo crop has been a great blow, and cotton and other crops have not yet compensated for its loss, though the areas under cotton and sugar are increasing annually to a very appreciable extent.

Percolation.—I regret to say that there are very few reliable data to be obtained on this question. Whatever experiments and observations have been made have been of a fitful nature, and in most divisions nothing has been done to ascertain loss; what is required is systematic series of observations by a very careful and experienced officer or subordinate who would take a real interest in the matter. He would traverse the different divisions at different times of the year.

The object of entrusting these observations to one man is, of course, that personal error would be eliminated.

Such an officer or subordinate should have such experience as would enable him to detect the conditions which govern loss by percolation and evaporation in various parts of the canal system in which he carries out his observations, *e.g.*, nature of soil, embankment, digging, presence or absence of puddle walls or of layers, lining channels, absence and presence of shade, presence of weed, etc., etc.

The Narora Division is the only one in which anything regarding loss by percolation is in any tangible shape. I took out some calculations of the percentage of loss between the head and Narora and the Nadrai Aqueduct in May last and sent them demi-officially to the Officiating Chief Engineer in reply to some query as to what became of the volume entering at the head. The distance is 33 miles and the percentage of loss was about 17 per cent, or about ⅙th. This loss must be considerably less than in former years, when weed was in profusion and the double banks between mile 12 and mile 22 were not completed. Since the tightening up of the channel to 150 bed width weed has almost disappeared, and the berm is forming well.

A good deal of loss in this distance is unavoidable, owing to the fact that the canal goes through *bhur* soil in miles 4 to 7 and again from mile 22 to mile 27 to a less extent onwards to the aqueduct. It is probable that even more is lost in these portions than in the embankments.

Farrukhabad Branch.—In Mr. Good's time, and when Mr. Nicools was in charge of the Branch and also in connection with the latter's special investigations the loss in that Branch was found to be 16 per cent. in the first 25 miles. It has much diminished in recent years, since excellent berms have formed sufficient height above full supply and weeds diminished.

Mr. Rigg has given me the following information with regard to observations on the Branch in recent years :—

(1) The result of nine experiments made from November 1895 to March 1896 gives an average of 4·16 per cent. loss by percolation in the first 125 miles.

(2) As the result of nine further experiments made after the above, the loss was reported 6·7 per cent. up to mile 25 ; 17 per cent. up to mile 60.

(3) Six experiments in April 1896 gave a loss of 9·2 per cent. up to mile 25 ; 15·7 per cent. up to mile 61.

(4) Six experiments in November 1896 gave a loss of 7·3 per cent. up to mile 25.

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He also forwarded the results of other experiments which gave percentages of loss at 3·6 in October 1896, and from 15·5 to 18·6 in *kharif* 1897-98, but the latter were considered unreliable.

From these figures given it would appear that in the first 25 miles of the Farrukhabad Branch (mostly in digging) the average loss is somewhere between 4 and 10 per cent. of the volume entering the head.

It is just possible that the large percentages obtained in *kharif* 1897-98 were due to weed in the Branch. Since then it has been tightened up, and berms have grown well and weeds disappeared.

Bhognipur is the only other Division which has made any observations, and during last *rabi* reports an averge loss of 12·6 per cent., but as that includes *some* escape water it is not of much use.

The loss in distributaries is even more difficult to ascertain without strictly accurate observations, and again Mr. Rigg is the only officer who has attempted to give even an approximate estimate after working it out from discharges at various points on his main distributaries and he finds it somewhat less than 8 per cent.

With regard to loss in *guls* the Executive Engineer, Cawnpore Division, can only give any reliable facts, as no other experiments on puddled *guls* have been carried out in this Circle, though they have been ordered for the ensuing *rabi* and *kharif* seasons in every Division. The result of Mr. Shavaksha's experiments on *guls* gives the following percentages of loss as measured on a length of one furlong from outlet exit:—

(*a*) In an ordinary *gul*, in its natural uncleared state, 19 per cent.

(*b*) In *gul*, properly cleared, 13 per cent.

(*c*) In *gul*, lined with sun-dried bricks, 8 per cent.

The same *gul* was experimented on in the three cases. These experiments were made in the hottest part of the year, *viz.*, June, and in the day time only, by Mr. Smith, apprentice Overseer. The number of observations in each case were four only, not quite sufficient to make the results absolutely reliable. The cost of lining was Rs. 20 per furlong. The drawbacks to *linings* of any sort are that they get destroyed by cattle in many places, and are liable to crack when the water-course is out of use.

The best form is probably a semi-circular, 6" thick layer, placed 6 to 9 inches below the true bed of the *gul* and terminating at about ½ to ⅔ of the height of the banks; if the *gul* is practically embanked, the cost works out to Rs. 120 per mile.

I regret I have not been able to give a fuller note, but in the absence of reliable informations I have considered it inadvisable to note down anything but facts; mere speculations on such a subject as loss by percolation are useless, and even some of the facts which I have brought forward may be the results of not strictly accurate observations in its full sense.

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1. *Q.* (*The President.*)—You have had a large experience of the whole of the Ganges Canal?—Yes.

2. *Q.* More on the Lower Ganges than the Upper?—Yes, and I have been at Bulandshahr for 9 months and Rohilkhand three years.

3. *Q.* You have sent us a very important paper upon the economy effected by re-lining the distributaries, putting in smaller outlets and so on?—Yes.

4. *Q.* Have you fixed the question as to what real economy you will be able to make for your whole circle and how you will employ it? It seems you will have an economy of 20 per cent. of the water; won't you?—The Lower Ganges Canal is essentially a *rabi* canal; most of our irrigation is in the *rabi*.

5. *Q.* Is the *kharif* not increasing?—It is not increasing. In fact, the loss of the indigo has been a terrible blow. We used up to do a lakh and eighty thousand before, and it has now dwindled down to thirty thousand for the whole circle. I was saying the Lower Ganges Canal is more of a *rabi* canal than it is a *kharif* canal, and during the *rabi* the supply in the Ganges river is very apt to fall low as it did in 1899-1900 and again last year, 1901-02.

6. *Q.* What do you consider your *rabi* discharge ought to be—3,000?—For the Lower Ganges Canal, if all the branches were to run together, it would be 5,800 cusecs.

7. *Q.* Can the river Ganges never produce 10,000 cubic feet in the *rabi*?—It never has done this. In years, when we were not very tight for water, the canal has run as much as 5,300 cusecs with all the branches running together.

8. *Q.* (*Sir Thomas Higham.*)—What is the maximum?—The maximum we run is about 5,300 in the main lines. It is divided up in two ways. Part comes from the river at Narora and part comes down the old canal. We are restricted to 1,644 cubic feet per second from the upper canal and the balance is made up by what comes down the river. That is about 3,800 cubic feet per second.

9. *Q.* (*The President.*)—Do you ever get that except in exceptional years?—Not until after the snow begins to melt in the beginning of May.

10. *Q.* That is too late for the *rabi*?—Yes, and for the early *kharif* too.

11. *Q.* With your economised outlets and with your earth-lined distributaries have you increased the irrigation much in the already irrigated villages?—Yes, I think we have.

12. *Q.* And do you know as to what percentage of area of land in the villages is now irrigated in the Lower Ganges Canal?—It varies.

13. *Q.* What is the maximum?—In some villages it must be 70 or 80 per cent.

14. *Q.* Don't you think that is too high?—Yes; I don't think it ought to exceed 60 per cent.

15. *Q.* (*Sir Thomas Higham.*)—Have you any rule about that?—On the Fatehpur branch a rule has just been made; it is confined to 40 per cent. there. We reduce it as much as we can. That is the reason we very often reduce the diameter of a *colaba* in villages where there is irrigation in excess of what is considered a proper percentage.

16. *Q.* (*Mr. Muir-Mackenzie.*)—You would only reduce it if you wanted the water elsewhere, or if you found it to be doing positive harm?—If we found it to be doing positive harm, we should certainly reduce it. We should not do it, merely because the percentage was high in one particular village; it might be high in one village and low in another, because the configuration of ground is different.

17. *Q.* Even in a tract which is already highly irrigated, you would not reduce irrigation, unless you wanted the water elsewhere or you found that the water was doing positive harm?—Quite so. I don't see what the object in reducing it would be otherwise.

18. *Q.* (*The President.*)—But in a country like this you may say the water is always wanted elsewhere? The only question is whether it is wanted more in one place than another?—Yes. The difficulty very often is to get at it (*i.e.*, the place).

(*Mr. Muir-Mackenzie.*)—In some years the demand is very much less than in others; it looks from that as if the water is not wanted.

19. *Q.* (*The President.*)—There is a part of these provinces which in the old days put in a strong claim for irrigation; that is to say, the Eastern Ganges Canal. I daresay you remember that Sir William Muir was very strongly in favour of it?—Yes.

20. *Q.* On the Fatehpur branch are you giving 40 per cent., or what is it?—Forty per cent. after deducting the areas on wells.

21. *Q.* (*Mr. Roberts.*)—Are you counting *kachcha* wells?—No, but where there are good suitable *kachcha* wells, we don't take the water. We may have to later on, but at present, where there are good suitable *kachcha* wells, we don't take the water.

22. *Q.* (*The President.*)—You have then a very much smaller percentage of irrigation on the Fatehpur branch than on the old branches?—Yes, a smaller percentage, I should say.

23. *Q.* (*Mr. Roberts.*)—How long has the Fatehpur branch been opened?—It was opened four years ago, but the first year it did nothing at all. It has been running practically for three years. This is its fourth *rabi* and the next will be its fourth *kharif*.

24. *Q.* (*The President.*)—You say in your statement "the substitution of more for less valuable crops naturally follows irrigation from canals of continuous flow. On the Fatehpur branch, which has only been opened for three years, already sugarcane is increasing"?—I don't say it is increasing by leaps and bounds; it increased 800 acres this year. In place of indigo they are taking to cotton in some places; on the Bhognipore Division cotton went up 15,000 acres last year, and on the Etawah branch it went up 9,000, and it has gone up in smaller amounts in other divisions.

25. *Q.* Does the cotton area fluctuate a good deal?—Yes. If the rains are early, you have a much smaller area; but if the rains hold off for sometime, you get a much larger area.

26. *Q.* The market prices would also affect it; would not it?—Yes, they are very good at present.

27. *Q.* (*Mr. Rajaratna Mudaliar.*)—Is irrigation taken for cotton before it is sown?—They *paleo* for it; if the rains are late, they will take a watering for it.

28. *Q.* (*The President.*)—Is not your experience that, as irrigation gets established in the district, the tendency is to increase the *kharif* and to lessen the *rabi*? Is not that your personal experience?—Not in this circle.

29. *Q.* Of course indigo is exceptional, but in the whole of the Upper Doab, as far as I remember, we used to begin with *kharif* as 10 per cent. of the whole and it got to about half and half.

30. *Q.* (*Mr. Roberts.*)—You are counting sugarcane and cotton as *kharif*?—Yes.

31. *Q.* (*The President.*)—The opium is *rabi*?—Yes.

32. *Q.* (*Mr. Muir-Mackenzie.*)—I suppose the classification as you put it is the *kharif* corps, the one that requires water very early in the season?—Yes. It requires water in May. We include sugarcane in the monthly *rabi* returns.

33. *Q.* (*The President.*)—What are your views about canal rates? Do you think they can be raised with advantage or not? I see on page 15 you say the *rabi* rate per acre Rs. 3·11 per acre and the *kharif* Rs. 2·38?—That is a mistake. It ought to be Rs. 2·38 for the *rabi* and Rs. 3·11 for the *kharif*.

34. *Q.* Then you say on the Fatehpur branch, whose rates are higher, the average occupier's rate would be about ¼ higher?—Yes, they are slightly higher. For instance, wheat is Rs. 4 per acre instead of Rs. 3 as on the Lower Ganges and Upper Ganges Canals.

35. *Q.* Do you think these rates have got as high as they ought to be or that they might be raised?—I don't think they could be raised; at least not in this circle.

36. *Q.* You have started with a higher one in Fatehpur?—Yes.

37. *Q.* Why should they pay more there, for instance, than on the Cawnpur branch?—Why should not the Cawnpur branch pay just as much as the Fatehpur?—It was decided when the project was being worked out that these extra rates would not be too heavy for the Fatehpur branch.

38. *Q.* If they are not too heavy for Fatehpur, why should they be too heavy for Etawah, Fategarh, and Cawnpur?—I think for parts of Fatehpur, at present, they are too heavy. I think for the lower part of the Fatehpur branch Rs. 4 an acre for wheat is rather heavy.

39. *Q.* (*Mr. Muir-Mackenzie.*)—When it is proposed to raise the rates on the United Provinces canals? I have understood that the revenue officers very often oppose it on the ground that the tenant cannot afford any addition to the rent he is paying?—Yes.

40. *Q.* And also that the landlord has succeeded in absorbing part of the money that ought to have gone to Government. Has not that been the case at all on the upper branches? Has it never been proposed to raise the rates?—It has not been proposed to raise the rates. It has been proposed but never carried out since last fixed.

41. *Q.* It has not been opposed on that ground by the civil authorities?—I don't know.

42. *Q.* (*Mr. Roberts.*)—There is no owner's rate in the Fatehpur branch?—No. Down at the tail of the Fatehpur branch towards Allahabad the cultivators are very poor.

43. *Q.* (*Mr. Muir-Mackenzie.*)—Do they refuse the water on account of the high rate?—No, I don't think they do. They don't actually refuse it, but they don't dig these *guls*. They are not up to digging their *guls* yet.

44. *Q.* Then if they don't refuse the water, why do you think the rates too high?—At present it is too high. They don't get the full benefit out of the water, because they are so inexperienced in irrigation altogether at present.

45. *Q.* If it did not pay them, they would not take it?—That is so, but they have not taken it very greedily down in the lower parts towards Allahabad up to now.

46. *Q.* (*Mr. Roberts.*)—Which parganas does the Fatehpur Canal run through?—It runs through Dhata and then gets into Allahabad district.

47. *Q.* Does it run through Khaga and Kakhreni?—Yes.

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48. *Q.* (*The President.*)—I see you notice that there was injury done in the Farrukhabad branch in the early days by water-logging due chiefly to excessive rainfall, but partially to the introduction of canal water without sufficient drainage. You have done a lot of drainage there since?—Yes. The whole of the Burgunga is now kept open and the water is drained through it. That is the old bed of the Ganges.

49. *Q.* Is that not in the Kadar?—It is in the Kadar in fact.

50. *Q.* You keep that open now?—Yes. That is one of the longest drains in the province.

51. *Q.* I don't know where the Farrukhabad branch goes. Is it along the *bhangar* of the Ganges?—Yes, and turns at Farrukhabad itself or rather a very few miles away from it into the Bhagah Nullah. The Mohiapur drain is another big drain.

52. *Q.* They have done a deal of good and have brought back land into healthy condition again?—Yes, the villagers are very much better, and people have returned to them.

53. *Q.* Have you done much drainage work in other divisions?—No, I have not.

54. *Q.* Is there much going on at present? Is there much remaining to be done on the Lower Ganges Canal still?—No, I don't think so. I don't think we need drainage so much in this circle, as it is needed in the First Circle or in the Third Circle. We don't get the same rainfall down here, as we do up above and further north.

55. *Q.* Passing on to your other paper, at page 151 you state a number of places where irrigation can be extended?—Where they might be, I would not be certain that they can be; but where they might be. One or two of these places I have seen in my tour this year; one of them was between Farrukhabad and Bewar, and after seeing the place, I don't think it would be a good thing to take canal water there.

56. *Q.* You allude here to the part that was debarred by Colonel Ross?—Yes. That was all round Kaimganj and Kampil.

57. *Q.* You have got a large circle?—Yes, six divisions.

58. *Q.* How are you off for establishment?—I have an Executive Engineer in each division and three Sub-divisional Officers in some divisions and two in others.

59. *Q.* But are your Executives generally Cooper's Hill men?—I have a Cooper's Hill man in Narora Division and a Roorkee man in the Mainpuri Division, and in the Cawnpur Division I have a Parsee, Mr. Shavaksha, and in the Fatehpur Division I have a young Cooper's Hill man, Mr. Riddell, and in the Etawah Division I have Mr. Cones, who is also a Cooper's Hill Engineer.

60. *Q.* Have you got a full staff of Sub-divisional Officers?—Yes, but there are very few Assistant Engineers. In fact I have not got one single Imperial Assistant Engineer. I have a promoted subordinate in the Northern Division in the first sub-division; the second sub-division is held by Mr. Butler, Sub-Engineer, nearly at the end of his service; the third sub-division is held by a native sub-engineer. In Mainpuri, in the first sub-division, I have a supervisor and I have an overseer, quite a young man with about two years' service in the second sub-division in charge of irrigation and water distribution. The supervisor is in charge of regulation, but the overseer is in charge of an irrigation sub-division. He looks after the work of the zilladars.

61. *Q.* In the ordinary way an Assistant Engineer does?—Yes, but he is not up to it, because he has very short service. Then I have a native overseer who has only been qualified about a year from his apprenticeship.

62. *Q.* Is it your experience that it works well in an irrigation charge to have an Upper Subordinate in charge of it?—I should prefer an Assistant Engineer, but an Upper Subordinate, who has served a long time in the Department, would, I think, be capable of running an irrigation sub-division if he had experience of it.

63. *Q.* Does he hold the position with the natives—with the zamindars—that an Engineer would?—No, not that an Assistant Engineer would, unless he was of very long standing.

64. *Q.* Have you had to interfere more closely yourself in cases of disputed water-rights and such questions of distribution where there is a subordinate than where

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there is an Assistant Engineer?—I think the Executive Engineers have to do it much more than they used to do. I think in former years an Assistant Engineer settled a great deal of this, more by his personal influence, and was more in sympathy with the cultivators and zamindars than these Upper Subordinates—some of whom are promoted sub-overseers—have or could have. These young Assistant Engineers of two years' experience, I think, would have more personal influence with cultivators.

65. *Q.* (*Sir Thomas Higham.*)—You have given us in this paper (page 71) the value of the crops in a dry year and also in an ordinary year, and from that you say the value in a dry year is 8 per cent. above the average?—Above the average in the three ordinary years.

66. *Q.* (*Mr. Muir-Mackenzie.*)—Would you reckon 1890-1900 as an ordinary year?—It was a year of considerable drought, but it was not a famine year.

67. *Q.* I mean the value jumps up tremendously. It goes up to near what it was in 1896-97, which was a dry year; would you then call it an ordinary year?—I would call it an ordinary year. I would call it an ordinary year in contradistinction to a famine year. By ordinary year I mean anything that is not a famine year.

68. *Q.* (*Sir Thomas Higham.*)—How do you get these values? What do they represent? They are obtained from the figures that the Deputy Magistrate gets. The Deputy Magistrate does all the valuing of the crops.

69. *Q.* Do they have a different estimate every year in the outturn and value of outturn, or do they merely modify the values?—The same return is sent in every year.

70. *Q.* But the outturn per acre is that constant for every year, or does that vary?—The value is made up of two things—outturn per acre and the rate per unit of outturn. I want to know whether your Deputy Magistrate gives you the outturn or how the outturn is determined?—I think he gets it from the tahsils.

72. *Q.* Tahsils can give information as to rate and as to the value per unit but what about the outturn. The tahsil could not give you any information about that; could it? Who estimates that? Canal officers don't estimate that?—No.

73. *Q.* There is no normal figure for a canal outturn?—I should not say there was.

74. *Q.* (*Mr. Roberts.*)—How do you estimate the outturn per *bigha*?—I think that must be estimated by the Deputy Magistrate himself.

75. *Q.* On what basis?

(*Sir Thomas Higham.*)—Mr. Gordon says it is all made out in the Secretariat.

(*Mr. Roberts.*)—I can see how it is done. The tahsildar every year sends round estimates of the produce crop for each tahsil. They estimate 16-anna as a full ordinary crop, and so the get these returns. The tahsildar returns say an eight-anna crop, and they multiply that into the area and work it out. It is sufficient to show that the yield in one year is greater than another, but it is not sufficient to establish Rs. 34 and Rs. 26 as being actual facts. You must take these as relative only.

(*Witness.*)—These are simply taken from the revenue reports.

76. *Q.* (*Sir Thomas Higham.*)—How long have the present occupier's rates been in force?—Many years.

77. *Q.* How long is it since your occupier's rates were raised?—I cannot recollect exactly when they were raised last. These have been in force all the time I can recollect.

Q. 78. You say that the owner's rate works out to about $\frac{1}{12}$ of the occupier's rate. I don't quite understand what that means. You mean that the occupier's rate is twelve times that of the owner's rate?—It comes to that.

79. *Q.* Is the owner's rate realised universally?—No, on the Fatehpur branch we have no owner's rate at all.

80. *Q.* After a settlement the owner's rate disappears?—It gets very much less or disappears altogether.

81. *Q.* Does the owner's rate bear any proportion to the occupier's rate?—It does bear a proportion, but I don't know exactly what proportion it is.

82. *Q.* Is it, for instance, like what it is on Western Jumna and the Punjab Canals, where the owner's rate is half of the occupier's rates?—I think it is less than that on the Ganges Canal.

83. *Q.* Is it a proportion of the occupier's rate?—It is. They say the owner's rate shall not exceed the sum fixed under the rules for the time being in force for the assessment of land revenue.

84. *Q.* (*Sir Thomas Higham.*)—I want to know what the rate is?—(Witness read the rule on the subject.)

85. *Q.* (*Mr Muir-Mackenzie.*)—When the land is assessed it is only leviable on land assessed at the settlement as unirrigated?—If it is assessed as unirrigated, they charge the owner's rate at one-third.

86. *Q.* When it is settled as irrigated, the owner's rate will cease, I suppose?—Yes. It is simply a divided occupier's rate.

87. *Q.* (*Sir Thomas Higham.*)—In those districts in which the owner's rate is not now levied, is any credit given to the canals for the increase in the land revenue due to irrigation?—No, I don't think they do.

88. *Q.* Do you get any indirect credit?—No, I don't think we do.

89. *Q.* Then as soon as the district comes under settlement, your canal returns go down. You lose your owner's rate and get nothing in its place?—In Fatehpur they have raised the rates for that reason. There is no owner's rate in the Fatehpur branch and the rates are higher there.

90. *Q.* What is this indirect revenue?—That is the credit we are given for the increase in the value of the crops.

91. *Q.* You don't credit the canal with the value of the crops. This must be for enhancement of land revenue or it must be on account of owner's rate?—It is not on account of the owner's rate; the owner's rate is separate from that.

92. *Q.* Then this must be on account of enhancement of land revenue?—Yes.

93. *Q.* You say that it is the practice now to run all your channels half-time?—Yes, generally so.

94. *Q.* I suppose that is only the case when the supply is below the demand?—Yes.

95. *Q.* If you got plenty of water and a strong demand, you would run all the channels?—We should run all the channels if we had got the water.

96. *Q.* You say you guard against water-logging by running channels in alternate weeks?—Yes, for instance, for *paleo* we would run all channels and possibly for *kor*, that is the first watering. We should try, if possible, not to run them full throughout the whole of the *fasl*.

97. *Q.* You run in alternate weeks simply to make the most of your supply, not to prevent water-logging?—Yes, not particularly to prevent water-logging. We know it does prevent water-logging though.

98. *Q.* It is only a case of running two channels at half-supply or alternately at full-supply?—That is so.

99. *Q.* You put just the same amount of water over the country?—No, for instance, supposing we were to run continually with a supply of 450 cusecs, as in the Bewar branch, we find we could do the same irrigation by running, say, 725 cubic feet per second in alternate weeks, but we should have to alter the channel and also alter the distributaries in order to suit the new system of running.

100. *Q.* You only run that in alternate weeks when you cannot get the water to run full time?—As a rule, in the *rabi*, we almost always have to run alternate time.

101. *Q.* In the *kharif* it does not affect you at all?—No because our *kharif* area is so small compared with the *rabi*

102. *Q.* Then you were saying something about reducing the size of your outlets. If you arranged to run your channels half-time, I suppose you would have to increase the size of your outlets?—Yes, in some cases you would, or give more.

103. *Q.* Give more what?—Outlets. You might increase the size of individual outlets or give a greater number.

104. *Q.* I thought you had been reducing the number and also the size of your outlets?—That is in places where they have been found to be excessive, as they were found in the Etawah branch. In the new branches they have never been as excessive as they were in the old branches like the Etawah branch. In the Etawah branch they were cut down tremendously. They were far too many in excess of what were really required. Those were cut down more than ten years ago.

105. *Q.* If you run half-time and the land is to be watered in seven days, instead of 14, *primâ facie*, won't you suppose you would want larger outlets?—Yes, but in this circle we have not had to alter the outlets very much?

106. *Q.* They were too large before?—They were too large before, I suppose.

107. *Q.* How much do you say you send down from the Upper Ganges now?—One thousand six hundred and forty-four cusecs; that is our limit.

108. *Q.* Some few years ago you were drawing a greater supply from the Upper Ganges; were you not?—We were drawing up to about 2,144 cusecs · 700 down the old Etawah branch and 1,444 down the Cawnpur branch.

109. *Q.* When you take that 1,600 and odd cusecs from the Upper Ganges, why don't you send it all down the river?—We have got to keep up boating in the Cawnpur Division.

110. *Q.* Navigation?—Yes; we must have 1,444 cusecs for that alone.

111. *Q.* Is it more economical to send the water down the river or by the Upper Ganges?—I should say it is more economical to send it by the canal. However, that was worked out sometime ago. The only thing is, if you send very much down the upper canal, the wear and tear of the works must be very much greater.

112. *Q.* I mean with reference to waste of water?—I should say we lose more going down the river.

113. *Q.* You think you would lose more?— I think we should.

114. *Q.* How long is it since they have cut down the river supply?—It is about a couple of years now. After Mr. Palmer's experiments, which showed we would lose less water by sending down the river, we were only supposed to lose about 3 per cent., but I think that is wrong; I am almost sure it could not have been less than 15 per cent.

115. *Q.* You think from your experience of the last two years that you would get more water if you sent it by the Upper Canal?—I think we should.

116. *Q.* In a year of very tight supply you think it would be better to send the water down the Upper Ganges?—I should say up to about a couple of thousand feet. We get it sooner for one thing, it is more easily reckoned for.

117. *Q.* You would not lose so much on the way?—I don't think so.

118. *Q.* With regard to these depths of wells you have given us, from where did you get them?—These are averages taken from the divisional returns.

119. *Q.* Averages for how many years, or is it only for one year?—These are taken for the last five years.

120. *Q.* Do you know what the depths were before canal irrigation was introduced?—I could tell you about the Bhognipur wells; they were between 60 to 80 feet deep.

121. *Q.* You don't know what they were in the Narora Division, for instance?—I could not tell you what they were in the Narora Division, but I could find out.

122. *Q.* In all these divisions canal irrigation has been going on for the last 40 years?—In Bhognipur and Mainpuri hardly 30 years.

123. *Q.* Have you any maps showing these extensions?—(Map produced and extensions indicated.)

124. *Q.* In regard to these wells in the irrigated tract, do you find that the canal cultivation has driven out the wells? Are the people giving up their wells or do they continue to subsist?—I think in the old divisions the wells are pretty well driven out. Take, for instance, Bhognipur, where we have been irrigating for five and twenty years or rather more.

125. *Q.* Have all the wells been driven out?—There are some wells which still irrigate.

126. *Q.* They are deep there?—Yes.

127. *Q.* Now in the Narora Division, where the water is much nearer the surface, is the canal driving out the wells there?—It has not driven out all the wells there.

128. *Q.* Don't they take canal water where the wells are?—They cannot very well; they would have to take tremendous lift channels. It is practically a debarred area.

129. *Q.* Is it the practice to debar areas that are served by wells?—Not universally; not in the old canals, but in the Fatehpur branch it has been rigidly done; where there is *pakka* well irrigation on the Fatehpur branch it has been rigidly debarred.

130. *Q.* You don't let the water go to it?—No.

131. *Q.* Supposing there is a well in one place and irrigated area all round it, how can you prevent the man owning the well from taking canal water?—Lists are made out and sent to the Commissioner who forwards them on to the Collectors through whom it is notified to the villagers that such and such areas round such and such wells are debarred. I sent the Commissioner a large number of statements the other day, giving the proposed wells and the proposed fields that are debarred.

132. *Q.* What happens if a man takes water?—We have not come across a case like that yet, but if such a case did happen, he would be prosecuted.

133. *Q.* You could refuse to give a water-course to that man; but supposing he gets water from another water-course you cannot prevent him?—I think we could under the Act.

134. *Q.* For what?—The unauthorised use of water; the same as a man who took water for making bricks with permission.

(*The Secretary.*)—These are the rules under the Act (shown). It was distinctly specified that there would be no prosecutions in such cases.

135. *Q.* (*Sir Thomas Higham.*)—I see from these rules if a man takes water the first time, he is charged double rate; if he takes a second watering, he would have to pay three times the rate, and so on. Is not that it?—Yes, just as fines were imposed formerly for wastage of water. Now we charge it in the *jamabundi* as an extra charge.

136. *Q.* Is it only on the Fatehpur branch you have irrigation debarred like that?—Yes, rigidly. There are a few tracts in other parts, not in my circle, but I have known of them in other circles where they have been debarred where water-logging had taken place.

137. *Q.* If irrigation has once been established, do they take it away?—Yes, I think in one or two cases on the Agra Canal this has been done.

138. *Q.* You have nothing of that sort in your circle?—No. It is only in this new Fatehpur branch where they rigidly debar *pakka* well irrigation areas. Captain Ross debarred that piece (shown on the map) because of the splendid wells there, and he also debarred the Aliganj piece because the water level was so high.

139. *Q.* (*Sir Thomas Higham.*)—I don't know whether we both mean the same thing by "debarred." Colonel Ross could not debar anything; all he could do was to propose that a certain area should be debarred?—What I mean by "debarred" is that it is illegal for a man to take water, and that he is liable to penalties where he does take it.

140. *Q.* That has only been carried out in the Fatehpur branch?—Yes.

141. *Q.* (*Mr. Muir-Mackenzie.*)—In answer to question 3, clause 3, page 69, you say that "your supply is sufficient, as a rule, for superior crops, such as sugar, garden produce, opium, tobacco, but insufficient for wheat and cotton; this, however, is not an obstacle to extension of irrigation." I don't understand why it is not an obstacle?—I mean to say we have such a lot of water in the *kharif* that we could extend them, if they would take water for *kharif* crops, we should have sufficient water for these crops.

142. *Q.* That is to say, your total irrigation might be extended if not the irrigation of these crops you have mentioned?—Yes.

143. *Q.* Then in the next clause you say "in some parts, where there is much *usar* irrigation is inadvisable." In Gwalior I saw some cases where *usar*, had been reclaimed by putting up *bunds* on the land and flooding the land and then draining off the water. Is that quite impossible in your *usar* tracts?—I should not think it was possible.

144. *Q.* Is there not enough drainage? Is the country too flat?—We could drain the water away, but I don't think it would be any good. There is a possibility of some kinds of *usar* which could be flooded with water and sown with rice. That is possible, and there are some *usar* tracts I have seen where they have actually broken it up of recent years and planted *rabi* in it, but whether they will go on planting *rabi*, I don't know.

145. *Q.* What has made it worth their while to break it up?—Its proximity to a distributary would induce them to do that.

146. *Q.* Because they get the water on?—Yes.

147. *Q.* What do they do? Do they just irrigate it in the ordinary way or do they flood it?—They irrigate in the ordinary way. It was on one particular distributary I noticed a good deal of *usar* land had been broken up in that way; it was not hopeless *usar*. It is a hard clayey sort of *usar*.

148. *Q.* (*The President.*)—Is it called *kala* land?—Not with us; in the Punjab it is, I think.

149. *Q.* (*Mr. Muir-Mackenzie.*)—Then when you say "large *usar* tracts" you mean this hopeless kind of *usar*; do

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you?—Yes. Of course I could not tell whether rice would grow well in *usar*; I should think it is worth trying. If there is any idea of reclaiming the *usar*, it would be a very good thing to try in certain parts where the *usar* is not very pronounced.

150. *Q.* Before applying irrigation to a tract where there was *usar*, you would like to have some experiment to see whether it is reclaimable *usar* or not?—Quite so.

151. *Q.* In answer to question 9 you say "the only obstacle that has come forcibly to my notice to the extension of canal irrigation is the fear of raising the spring level to an undue height." You have generally found, have you, that since the introduction of canals the spring level has very largely risen?—The spring level has risen, but not equally everywhere.

152. *Q.* And what about the difference in villages close to the main line of the canal and of villages at a distance?—The spring level would be higher nearer the main canal.

153. *Q.* Have you observed instances in which the spring level has been unduly raised close to the canal and not been unduly raised at a distance from it?—Yes.

154. *Q.* Would you be able to say an undue rising of spring level generally takes place only in proximity to the canal?—I should say the greatest rising in spring level would be close to the canal.

155. *Q.* You cannot go so far as to say the spring level would be raised unduly only in proximity to the canal?—No. Very heavy rain affects the spring level tremendously.

156. *Q.* I mean the rising due to the canal?—The difficulty is to tell how much is due to the canal and how much to very excessive rainfall. In a year of very excessive rainfall there is a very marked rise in canal irrigated districts in the levels in the wells.

157. *Q.* Is the rise due to rainfall greater in the canal irrigated districts than in districts which are not irrigated by canals?—Of course it would, because there is the combined effect of the two in the canal irrigated district.

158. *Q.* You have it without years of excessive rainfall the canal rises to 10 feet. Then you have a year of excessive rainfall. Supposing in that year it causes a rise of 10 feet in the unirrigated districts, do you think it would cause a rise of 15 feet in the canal irrigated districts?—Yes, it might do so.

159. *Q.* In the case of the canal irrigated tracts you think there would be an additional rise of five feet You say instead of 10 feet the rise in the level would be 15 feet?—No. The proportionate rise would be the same.

160. *Q.* How cannot this rising in spring level be effectively cured by drainage?—I don't think any drainage would cure it, unless the spring level got so high; that is to say, within 4 or 5 feet or 2 or 3 feet of the surface, as I have seen it in one or two places.

161. *Q.* Have not there been instances in which spring level has been greatly raised since the introduction of a canal and lowered by means of drainage works?—Drainage has carried off the rain water and so prevented that amount of water percolating into the ground; anything like the subsoil drainage we have at home would not be any good.

162. *Q.* I mean your big drainage operations?—They must be a certain advantage in that way, but anything in the way of sub-soil drainage or in the way they treat moist land at home would not be any good in this country.

163. *Q.* What ground have you for supposing that? Is it tried?—I have never tried it myself, but I don't think it would be any good.

164. *Q.* Do the cultivators try it?—Never. I have never known the cultivators do anything but surface draining.

165. *Q.* With reference to this question of rates, I understood from you just now that the higher rate on the Fatehpur branch was not sufficient to make the cultivators refuse the water?—No.

166. *Q.* It only was sufficient to reduce their avidity for the water?—Yes.

167. *Q.* Do you think that is an injurious thing?—No. I think as years go on they will take to it perfectly well. They are at present very inexperienced in irrigation all the way down.

168. *Q.* Do you think it is a positive advantage that irrigation should be introduced gradually into a country?—Yes

169. *Q.* Therefore don't you think it might be advantageous, unless it were shown that the cultivator is already paying too much in the form of rent, or that he is paying in some other way such a high rate that he cannot have any increase to raise the rates on the canals where they are lower than at Fatehpur?—I think they would stand a certain amount of raising on certain crops.

170. *Q.* On which crops?—I think wheat could stand a four-rupee rate perfectly well.

171. *Q.* And possibly certain other crops?—Yes.

172. *Q.* For instance?—Well, I don't know about opium.

173. *Q.* Sugarcane?—Cane, I think, could stand a very small increase; it is Rs. 6-10-8 now.

174. *Q.* You regard that as a very high rate?—I regard it as a very fair rate.

175. *Q.* (*The President.*) How long is it since that rate was imposed?—I don t recollect.

176. *Q.* (*Mr. Muir-Mackenzie.*)—Is the sugarcane Rs. 10 on the Fatehpur branch?—Yes.

177. *Q.* Don't you think it would be a good thing if it were to be put up to Rs. 10?—I certainly think so in the upper divisions of the Ganges Canal, but I don't think so in this circle. We are very limited in the matter of sugarcane compared with the Upper Circle. They do 180,000 acres, and we only do 35,000. I think if we put the rate at Rs. 10 per acre here it would affect the area.

178. *Q.* It would bring down the area you mean?—I think it might.

179. *Q.* Has not the area small as it is increased considerably of late years?—Not very considerably, but it has increased.

180. *Q.* Would you advocate a gradual increase up to Rs. 10 per acre?—Yes. I think the Upper Ganges Canal and the Eastern Jumna Canal could bear raising up to Rs. 10. I am not very well acquainted with those two circles, but from what I have seen of the crops up there during the short time I officiated in one or two divisions, I should say you could raise it up to Rs. 10.

181. *Q.* Is not sugarcane generally grown by very well-to-do people?—No, I don't think so, invariably.

182. *Q.* With reference to what you say in answer to question 11 "I don't think that much damage has resulted . . . except in isolated cases." What is the general cause of that unfitness?—There have been a few cases of water-logging, but I don't think there has been any large extent of deterioration.

183. *Q.* You have not noticed any extensive deterioration owing to the tendency to extend cultivation too much?—No, I have not.

184. *Q.* Or absence of manure?—It is well known there is not sufficient manure in the country.

185. *Q.* It is alleged by some people that canal irrigation induces people to cultivate a larger area than they can manage or manure, and that the soil is exhausted by the first few crops that are obtained, after which the produce sinks lower and lower; have you seen anything which justifies that statement?—No.

186. *Q.* Was there any famine relief in the tracts of your circle in 1896-97?—I had not a circle in 1896-97.

187. *Q.* Where were you in that year?—I was in Roorkee and Bulandshahr; there was no famine there.

188. *Q.* (*Mr. Rajaratna Mudaliar.*)—What is the rate for a preliminary watering for cotton?—That would be the rate on the whole crop that comes to maturity, Rs. 3.

189. *Q.* Although you did not give it a watering?—Unless they *paleod* for sowing they would not get a crop at all; they benefit in that way.

190. *Q.* Would you advocate a reduction in the rate in order to extend the area for such irrigation?—No, I would not.

191. *Q.* (*Mr. Muir-Mackenzie.*)—Do you think the *kharif* that you have lost under indigo will soon be recovered?—I don't think we shall ever get up to the same area with cotton; I think it will fluctuate a great deal more.

192. *Q.* Would it not be worth while to reduce the rate for a few years in order to induce them to take up the area?—It is impossible to say what the effect would be. I don't think it would be good policy to reduce it; the rate for cotton is not a high rate; they get a good price besides; last year they said the outturn that they got on canal irrigated fields was double that on fields dependent on rain.

193. *Q.* (*Mr. Rajaratna Mudaliar.*)—Lands irrigated by wells are often surrounded by canals; what prevents the

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surreptitious use on such lands of water from canals?—The patrols go over their beats.

194. *Q.* Would it be possible to effectually prevent this?—Quite; it might happen in a few cases, but they would be almost certain to be found out; there is a constant check by zilladars, amins and patrols. The zilladars has lists of debarred fields, and lists are also given to the patrols, so that detection would be fairly easy.

195. *Q.* Do you debar canal water to tracts where the wells are few and scattered?—No.

196. *Q.* Only where the well area is very large?—Yes, round particular wells.

197. *Q.* (*Mr. Roberts.*)—Have you had any complaints about the subordinate staff in the sub-division?—No.

198. *Q.* Of course an Assistant Engineer would not connive at any extortion on the part of patrols and zilladars, but can you rely to the same extent on your overseers?—I have had no complaints brought before me; there is no doubt they have not the same administrative ability and they are not looked upon by the people in the same way as an Assistant Engineer. Of course there may be some cases on the part of patrols, but there is a great deal of checking by *amins*, who are checked by patrols and they are again checked by zilladars; the Assistant Engineer does a lot of checking; also the Deputy Magistrate and Executive Engineer. Quite 25–30 per cent. of the whole area is checked by Deputy Magistrates and Sub-divisional Officers.

199. *Q.* You have noticed the extension of cotton cultivation; have you noticed whether they are introducing any better kind of cotton, or is it just the ordinary *kapas*?—The ordinary *kapas*; experiments are being made on the Government farm at Cawnpore.

200. *Q* On the canal irrigated area is there cotton solely, or is it mixed with other crops?—It is mixed with other crops.

201. *Q.* Even on irrigated lands?—Yes.

202. *Q.* The reason for the mixture is said to be the protection which it affords to the young plant; that is not so necessary on canal irrigated lands?—No.

203. *Q.* (*The President*).—Are there any divisions in which there are nothing but subordinates?—Yes, in the first and second sub-divisions of the Cawnpore Division there are overseers.

204. *Q.* Are these the only Assistants the Executive Engineer has?—Yes.

205. *Q.* Are they put in if the officer goes on leave?—Not if he goes on privilege leave for a month or two; only if he is away on casual leave of, say, ten days.

WITNESS No. 52.—MR. J. E. HAND, Opium Agent, Fatehgarh.

Mr. J. E. Hand.

16th Dec. 02.

1. *Q.* (*The President.*)—You are Agent of the Opium Department in Fatehgarh?—Yes.

2. *Q.* Have you a wide beat?—Yes, the whole of the Fatehgarh District.

3. *Q.* Have you much opium in the canal irrigated country?—A good deal.

4. *Q.* Opium prefers well water; does it not?—It is better; it is warmer for one thing.

5. *Q.* Would people prefer to grow opium on wells in preference to growing it from canal water?—If the two were side by side, they would prefer wells.

6. *Q.* They would go to the expense of drawing the water up?—I think so; they are using wells now in some villages for opium even where there are canals.

7. *Q.* How much opium have you?—About 33,000 *bighas*.

8. *Q.* Is opium extending?—Not for the last 3 years; we have got more than we had 5 years ago.

9. *Q.* I suppose it is a very profitable crop to the people; have you any complaints about the rate for canal water?—No; lately they have not had enough water.

10. *Q.* Is this all done by advances?—Yes.

11. *Q.* Who gives the advances?—I do for half the district and my assistant for the other half.

12. *Q.* Do you personally take about a bag of rupees?—Yes, we take the cash with us.

13. *Q.* To whom do you advance the money?—To the *kashtkar*.

14. *Q.* What security does he give?—There is a joint agreement; they stand security for one another.

15. *Q.* Do you find that they often fail you?—No, I have never had any balances.

16. *Q.* Do you never have to prosecute a man for not refunding the money?—We have never prosecuted; the Collector assists us sometimes to recover, but it always comes in.

17. *Q.* (*Mr. Roberts.*)—It is collected like land revenue?—Yes.

18. *Q.* Cases very rarely go to the Collector?—Yes, very rarely. These are all advances for growing opium.

19. *Q.* (*The President.*)—Do you give advances for making wells?—Yes.

20. *Q.* To what extent?—I give up to Rs. 100 for a well which is not of masonry, but only bricks set in mud and clay.

21. *Q.* What does a well cost?—It depends on the depth of the water and the sand; I should say it costs from Rs. 100 to Rs. 400.

22. *Q.* What time do you give for repayment?—Two years and we take no interest.

23. *Q.* Is poppy alone supposed to be grown in such a case?—No, anything can be cultivated.

24. *Q.* Are they not under engagement to grow poppy?—No, only to increase it.

25. *Q.* Supposing you give an advance for a well and no poppy is grown?—We only give advances to opium-growers.

26. *Q.* I suppose you say—"I give you an advance for a new well and I expect you to grow so much more opium"?—Yes.

27. *Q.* What is about the average value of a *bigha* of opium?—It varies in each district; in Fatehgarh it averages Rs. 30 a *bigha* for opium alone; the seed is separate

28. *Q* Does that come to much?—Rs. 12 to Rs 14.

29. *Q.* Are there any complaints about canal administration?—No.

30. *Q.* They don't complain of cheating and corruption?—No. I have not been able to get all my poppy sown on account of water being scarce; our cultivators are not the swell cultivators of the village; the Thakurs and Brahmins get water first, and by the time our men's turn is reached the water stops.

31. *Q.* That should be capable of arrangement?

(*Mr. Roberts.*)—The distribution is left in the hands of the villagers.

(*Witness.*)—Formerly the supply ran for an unlimited number of days. Now every alternate week. Not only poppy suffers, but the villages at the tail end get no water for *rabi*.

32. (*Mr. Roberts.*)—When do you require water for poppy?—From November to the middle of March.

33. *Q.* And pretty often?—Yes.

34. *Q.* (*Mr. Muir-Mackenzie*)—What is the amount of advance in a year?—This year the total advances for crops and all comes to about 12 lakhs.

35. *Q.* That was made by you and your assistant?—Yes.

36. *Q.* How much was for opium and how much for wells?—Wells would be under Rs. 2,000.

37. *Q.* These are *pakka* wells?—They are made of brick. I have had 93 wells made in my portion and my assistant has made 20 since last year.

38. *Q.* You have not got beyond about 100 wells in the year?—No; that is a lot.

39. *Q.* Have you any desire to get beyond that?—We would like to make as many as possible. We work through tenants only.

40. *Q.* Why are there so few?—In some districts zamindars are against it; in Oudh they object to it.

41. *Q.* Why?—Because it gives a tenant occupancy rights.

42. *Q.* (*Mr. Roberts.*)—It gives them a right to compensation?—That is a kind of occupancy right. In Fatehgarh they have been objecting.

43. *Q.* Why did they object in Fatehgarh?—On the same grounds.

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44. *Q.* (*Mr. Muir-Mackenzie.*)—What sort of security do you take for wells?—I generally take a mango grove; if a man has not a mango grove, he has to bring as collateral security some one who has.

45. *Q.* Do you think the difficulty of finding security is another obstacle that prevents your extending wells?—No; security has always been found.

46 *Q.* (*Mr Roberts.*)—There is the *lambardar?*—Yes; he is only jointly responsible with the man brought in.

47. *Q.* (*Mr. Muir-Mackenzie.*)—You have also the security that the man is already growing a poppy crop?—Yes.

48. *Q.* Therefore you know he is a substantial man?—Yes.

49. *Q.* You generally recover in two years. but I suppose you sometimes allow a postponement?—Yes, if crops are bad.

50. *Q.* I suppose you would never have been able to get rid of these large sums if you did not take money about with you?—If we did not go about, we could not get all our cultivators to come in.

51. *Q.* What do you mean by coming in?—Come in to head-quarters for licenses and advances.

52. *Q.* Have these wells been useful for other crops than poppy?—Yes.

53. *Q.* Do they irrigate other crops?—Yes, frequently.

54. (*Mr. Rajaratna Mudaliar.*)—To what extent does the restriction in canal supply affect the outturn on poppy? Does it very seriously affect it?—Not much; only the tail ends of distributaries are affected. I expect I lost not more than 1 per cent.

55. *Q.* In these areas it would not be worth while for the tenants to sink wells?—That is what I am advancing as much money as possible for; wells to supplement canal water.

56 *Q.* Supposing you extend the period of repayment for loans, do you think you will be able to levy a small rate of interest on advances?—We don't want interest; the increase of a seer of opium is more than the interest we could get and is a distinct gain to Government.

57. *Q.* (*Mr. Roberts.*)—What is done with regard to advances for wells?—Cultivators apply to us.

58 *Q.* Have you had to refuse any cases for want of money?—Not for want of money, but on account of incompetence on the part of the cultivator.

59. *Q.* On what grounds would you refuse?—If a man cannot furnish good security, or if he is a man of straw.

60. *Q.* Are there many such cases?—There are a few.

61. *Q.* On the whole, when you have given money for 100 wells in the year, is that as much as you could do, or could you have done more if you pressed people to take money for wells?—I think we are going as fast as we can. By the end of the year I hope to get some more done.

62. *Q.* Would giving a dredger be of use?—I think so. I got one sanctioned in Rae Bareli, and it did a lot of good.

63. *Q.* Is there any difficulty in knowing whether a well will be a success or not?—I have known failures.

64. *Q.* Do you know that from the Cawnpore experimental farm you can get the loan of boring tools?—I did not know that.

65. *Q.* And an expert to work them on a small payment of about Rs. 10?—I did not know; we work through tenants and they are not rich men.

66. *Q.* A well costs more than the amount of the advance?—Yes, we give about half.

67. *Q.* (*Mr. Muir-Mackenzie.*)—Why don't you work with zamindars?—They are against us.

68. *Q.* Are there any small cultivating zamindars?—Yes, we work through them often.

69. *Q.* (*Mr. Roberts.*)—You are referring to non-cultivating proprietors?—Yes.

70. *Q.* Would your department be of any use in advancing money to ordinary tenants?—Where is the security? If the Collector engages to get the money back in case of failure on our part, we could do it.

71. *Q.* Cannot you recover advances for wells in the same way as land revenue?—I don't know.

72. *Q.* Is it a lien on the crop?—I do not know about other crops; on ours it is.

73. *Q.* The *takavi* given by the Collector could be recovered like land revenue?—If the Collector assisted us, we could advance money to non-opium growers; they would take it more readily from us, because we would give it ourselves.

74. *Q.* (*Mr. Muir-Mackenzie.*)—You have worked in Oudh?—Almost all my service has been there.

75. *Q.* You found zamindars opposed to tenants making wells?—There was great difficulty in Gonda and Bahraich.

76. *Q.* (*Mr. Roberts.*)—In Gonda there are only one or two big zamindars; do you mean talukdars?—Yes, and the Pandeys.

77. *Q.* In Balrampur?—Yes.

78. *Q.* Did the Raja of Nampara object?—Yes.

Mr. H. Nelson.
16th Dec. 02.

WITNESS No. 53.—MR. H. NELSON, Executive Engineer, Mat Branch, Ganges Canal, Muttra.

1. *Q.* (*The President.*)—What are you employed on just now; there is no irrigation; is there?—No; my work is purely constructive.

2. *Q.* I notice you talk about the advantage of alternative weeks of closing distributaries; that is not a new thing?—No.

3. *Q.* You say you have done a lot in drainage; did you take careful observations of wells before making drainage lines?—Yes.

4 *Q.* And now that they are made, what has happened?—I find the spring level has fallen (conversation over map.) The water level in a water-logged tract was reduced to 10 or 12 feet by drainage works constructed since 1892.

5. *Q.* Do your drains pierce through the clay stratum?—Yes, I went in few rather deep drains.

6. *Q.* You speak in your note (manuscript) of puddling banks; have you done much of that?—Two miles in Secunderabad near Dasua it reduced the surface of the *jhil* a little; with a lower gauge I got sufficient water into the *rajbaha.*

7. *Q.* Is the puddling of distributaries practicable?—Yes.

8. *Q.* What would it cost?—Rs. 5,000 to Rs. 10,000 per mile.

9. *Q.* Is that a medium sized distributary?—Yes.

10. *Q.* Had you many miles of distributary?—Over 700 miles. I would only go in for this where the soil is very sandy and the percolation excessive.

11. *Q.* Do you find the berms formed by a deposit inside the distributaries check percolation?—No.

12. *Q.* When you are at work, what is the spring level?—About 20 to 30 feet.

13 *Q.* Are you having these wells carefully measured from time to time?—It has not yet been done; the division has only just been formed; it is going to be done; I think it has to be observed twice a year.

14. *Q.* (*Sir Thomas Higham.*)—You make a great deal of running channels in alternate weeks?—Yes.

15. *Q.* Would you do that all the year round?—No; only when water got tight.

16. *Q.* You regard that in your note as the great remedy for water-logging?—Yes, and to prevent percolation.

17. *Q.* In a wet year when there is plenty of water and the danger of water-logging is greatest, you don't go in for it?—I would if I had my way; I would have an alternate supply a week all the year round and more especially in the wet months; for instance, I don't think there is much harm in running it in the early *kharif;* for *rabi* I would certainly go in for alternate supplies.

18. *Q.* When you have a dry *rabi* and water is in great demand, it cannot make much difference if you run half supplies the whole time?—Yes, it makes all the difference; we have worked it out and find it is better to have four or five days' full supply rather than two weeks of half.

19. *Q.* As regards irrigation, but as regards drainage?—It does not affect drainage, but it affects percolation; the cause of water-logging is not obstructive drainage, but super-saturation of the soil; if there is too much water in the soil, it cannot absorb the rainfall.

20. *Q.* Then in order to relieve water-logging you give less water to the people?—You give them sufficient water to bring their crops to maturity.

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21. *Q.* It will not make any difference whether you run it constantly or in alternate weeks, provided you don't run too great a quantity of water?—Yes, it does. In alternate weeks a certain amount of water has had time to evaporate; if you constantly keep the supply going, it cannot evaporate and the soil remains saturated or moist.

22. *Q.* I don't understand the magic of running it alternately?—We have rigid rules that no *rajbaha* is to run more than five weeks.

23. *Q.* However keen the demand?—Yes, I wanted to reduce it to three weeks running and one week closed.

24. *Q.* Why one week closed?—In order to reduce the saturation. At the beginning of each *fasl* you take as much water as you like, but when water is tight, the supply is reduced; then you introduce another roster by which there will be two weeks' running and one week's closure and then one week's running and one week's closure.

25. *Q.* The only land you give rest to is the bed of the channel?—No, the whole of the land is given rest; the surface has nothing to do with it; it is the sub-soil; we lose 75 per cent. of water in sub-soil percolation; that is what you want to give rest to.

26. *Q.* That percolation is not from the channel of the distributary?—About one-half is from the *gul* certainly.

27. *Q.* Your system may have the advantage of giving people water in turn, but I don't see how you reduce percolation by the magic of running half-time?—If you run water constantly, you have water constantly in the sub-soil.

28. *Q.* What is the state of your work?—The work is just now being given out on contract.

29. *Q.* What is the depth of wells in the tract?—It varies; at the head it is 20 feet below the surface; down here past Agra it is sometimes 100 feet; the tract that requires relief is about 60 to 80 feet.

30. *Q.* Have you designed your water-course system?—No, we are going to do that.

31. *Q.* And the minors?—No, we have only a limited supply of water and want to see if it will be sufficient for the new channels.

32. *Q.* What are you going to do about water-courses?—Villagers will make their own; I am going to advise them; I have maps on which the drainage and sub-water sheds are marked; I will tell the villagers where the *guls* should be made, and will insist, in some cases, on their making them.

33. *Q.* At the end of this new branch where the spring level has fallen 20 feet is there well irrigation?—Yes.

34. *Q.* Are you going to give water-course to villages where there is well irrigation?—*Pakka* wells will be debarred, but not *kachcha* wells.

35. *Q.* Would they not make them *pakka* if they were not given water?—Perhaps they would. I may mention that the extension of this branch has another object; it is not only for irrigation; it is to relieve the country generally; the country can scarcely get sufficient water for drinking; the water is brackish, oily, poisonous and salt; as soon as a canal comes, most of the *pakka* wells become sweet. In the last 15 years the spring level has fallen 20 feet, and the water is not drinkable.

36. *Q.* Why has the spring level fallen?—It is due to dry years, and people say there is over-irrigation; all the water has been drawn out of the Jumna in this part of the world.

37. *Q.* Where there are *kachcha* wells you give water?—If they want water, they can have it.

38. *Q.* If they have *pakka* wells, you debar them?—Yes, but not at present.

39. *Q.* If they can do irrigation by *kachcha* wells, why do you give them water?—They cannot do it.

40. *Q.* A man is at a great disadvantage if he makes a *kachcha* well *pakka*?—No; he will get sweet water for nothing.

41. *Q.* He has to lift it?—Yes, but the spring level is raised.

42. *Q.* You anticipate that as a result of bringing this canal here *kachcha* wells will fall in?—Yes, but not all those within a radius of half a mile of the canal will be thrown out of use; beyond that for a distance of 1 or 2 miles, I think, they will be improved.

43. *Q.* (*Mr. Rajaratna Mudaliar*)—What is the object of debarring *pakka* wells?—A canal is introduced into a tract of country to raise its irrigable capacity, when you bring a canal into a certain tract, and there are wells there; if you don't debar the wells, you don't increase the irrigable capacity of the country, so you don't make the most use of your canals. If you have canals, *plus* wells, you have two sources of irrigation; if you abandon wells, you have only one source, and that might dry up.

TWENTY-EIGHTH DAY.

Meerut, 19th December 1902.

WITNESS No. 54.—MR. F. W. BROWNRIGG, Collector of Aligarh.

Mr. F. W. Brownrigg.

19th Dec. 02.

1. *Q.* (*The President.*)—How long have you been Collector of Aligarh?—Since July 1901.

2. *Q.* Before that you were in Sultanpur?—Not immediately before that; I did the settlement in Sultanpur.

3. *Q.* You were in Mainpuri also?—Yes, in 1890-91. I was acting as Collector part of the time and was re-assessing some of the deteriorated tracts of the district.

4. *Q.* You have had large experience both of canal-irrigated country and country where canal irrigation has not been?—Yes; I settled four parganas in the Saharanpur District too.

5. *Q.* What was the deterioration in Mainpuri?—Due to saturation of the sub-soil and the growth of *kans*.

6. *Q.* Was the former due to the Ganges Canal?—It is impossible to say what it was due to. Nobody, I suppose, could say anything more than that it was due to excessively heavy rainfall. I thought at the time it was due mainly to the canal, but I would not probably hold the same opinion now.

7. *Q.* (*Mr. Thomas Higham.*)—Was it in the canal-irrigated tract?—Yes.

8. *Q.* (*The President.*)—Was the spring level brought up very much?—Yes.

9. *Q.* (*Mr. Muir-Mackenzie.*)—Did the super-saturation disappear with the dry years?—I was not there when the dry years came. I believe it has, to a great extent, disappeared.

10. *Q.* (*The President.*)—You were there for a series of wet years?—Along the Kali Nadi tract the *kans* set in. There had been wet years, but the principal deterioration was due to the flood from Nadrai aqueduct in 1885.

11. *Q.* They think that that flood had ruined the country?—The difficulties had set in then; I do not think it received enough attention; the seriousness of it was not realised. Afterwards, instead of remitting the revenue as freely as might have been done and would be done now, it was collected with more severity than it ought to have been.

12. *Q.* The flood that broke the aqueduct lasted only a few hours, I suppose?

(*The Secretary.*)—It lasted several days.

13. *Q.* Did you recommend a large remission of revenue?—Some reduction. Over 150 villages in both tracts—the *kans* and the canal.

14. *Q.* Was this *kans* a new thing there?—Not new. There is always the tendency to *kans* there—a light, poor tract along the Kali Nadi.

15. *Q.* Did you hit on any means of getting rid of it?—There are no means that I know of. It dies a natural death when the cycle is over, and does not come again till another series of years has passed.

16. *Q.* A kind of disease in the ground like the potato disease in Ireland?—With good cultivation you will never have *kans* at all.

17. *Q.* (*Mr. Muir-Mackenzie.*)—Cultivation had been neglected. What was the cause?—The ground was naturally light, and they were simply giving up cultivating the lighter tracts.

18. *Q.* (*The President.*)—You could not say it was due to over-irrigation or this flood?—No; it started probably with the heavy rains which brought on that flood.

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19. *Q.* You have been one and-a-half years in Aligarh?—Yes.

20. *Q.* You have seen the parganas where there is irrigation and those where there is none?—Yes.

21. *Q.* Do you approve of the Mat Branch extension?—Yes; it ought to do a lot of good in relieving the bad parts there.

22. *Q.* You have taken notice of the fact that the spring level has very much gone down in those parts?—A good deal on the western border. Generally in other parts of the district too.

23. *Q.* Is there any question of increase or decrease in the quantity of *usar* land in the Aligarh District?—It is certainly not on the increase.

24. *Q.* There has been a great deal of money spent in the Aligarh District on drainage?—I believe so.

25. *Q.* You have not heard whether any land has been brought back to cultivation owing to that? The impression was that land might be reclaimed from salt?—The low-lying swamp ground has been reclaimed, and where there used to be swamps you will find cultivation now. I do not know about *usar*.

26. *Q.* Does canal irrigation generally give satisfaction in the district?—There are no complaints of canal irrigation.

27. *Q.* Or of the administration?—No.

28. *Q.* Are your relations satisfactory with the canal officers?—Perfectly.

29. *Q.* You have no change to suggest?—No.

30. *Q.* To go back to Sultanpur; apparently there is very high well-irrigation there,—42 per cent.?—The whole irrigation would be over 44 on everything,—swamps, wells and miscellaneous sources.

31. *Q.* The well area, I presume, is much the larger?—The irrigated area from wells is 50·9 of the total; swamps and tanks, 48·2; and a fraction under 1 per cent. from rivers and miscellaneous sources. Irrigation extends to 44·7 per cent. of the cultivated area of the district.

32. *Q.* Had they any famine there in this last year of famine?—We suffered from scarcity in 1896-97. We were under observation as a distressed district, but not actually declared a famine district.

33. *Q.* I suppose the marsh and tank irrigation disappeared?—Very largely.

34. *Q.* Did any of the wells run dry?—Not perceptibly.

35. *Q.* I suppose there is a large number of earthen wells there?—Yes. I recollect once seeing as many as 70 wells in a single village. Every field almost had its well.

36. *Q.* How is the spring level there?—It varies from 18 to 20 feet or 30 feet or more. In one part of the district is a clan called Bhale Sultans, or "Lords of the Spear." They do not believe in masonry wells at all; they will not grow cane, and they will not live in tiled houses. They served under the King of Delhi in the olden days and for their bravery were allowed to call themselves Bhale Sultans, and they settled down in this tract of the country. It probably had a very good sub-soil and earthen wells lasted, so that they got into the habit of not making masonry ones. Probably there was a lot of grass, so that they could always get plenty of thatching, and so they never had tiles; while the objection to cane arose from the old idea that there was a feud through growing cane. One brother said he would grow it, and another brother said he should not and they had a fight over it, and one was killed, and so in future no one was allowed to grow it.

37. *Q.* Is there a touch of the nomad about these people?—No; they are waiving these things now to a certain extent. Some make masonry wells and some even live in tiled houses. It is a beautiful cane tract, and I think in time they will grow it.

38. *Q.* Are they going on making wells in that district?—I suppose so. It is four years since I left Sultanpur. There were 16,453 wells in the Sultanpur District in 1898.

(*Mr. Muir-Mackenzie.*)—That does not accord with Mr. Moreland's figure.

39. *Q.* (*Mr. Roberts.*)—What was the classification?—Only masonry.

40. *Q.* (*Mr. Muir-Mackenzie.*)—How do you class half masonry wells?—If there is any masonry in a well, I call it masonry.

41. *Q.* (*The President.*)—In that year there was famine pretty severe, not very far from Sultanpur. If it had not been for this irrigation, they would have suffered severely?—Yes, and for the large advances made for earthen wells and for inducing them to sow. We sowed in that year 75 per cent. of our normal *rabi* area and had a crop of wheat never known before or since. There was not a failure in the whole place. We shall probably never get a crop like that again.

42. *Q.* Raised entirely by artificial waterings?—Yes, and by the 1½ inches we had in January 1897. That entirely saved the situation.

43. *Q.* Was it a general fall?—Yes.

44. *Q.* That was the end of the tension everywhere?—No; the tension could not be said to be over until the 1897 crop was in.

45. *Q.* But it lowered prices?—It was a tremendous help, of course, to everyone.

46. *Q.* What does the Sultanpur District require to make it still better protected?—We can do nothing more than encourage the making of masonry wells and give liberal advances for earthen wells.

47. *Q.* Are the people ready to take *takavi* loans for wells?—For masonry wells they do not want them very much. Most of these wells were made by the tenants, not by the landlords. In 1896-97 in the Sultanpur District we advanced Rs. 80,000 for making masonry wells, using that partly as a system of famine relief, because we calculated that it employed a certain number of men at a useful time when labour was badly wanted when the crop cutting was done after the hot weather. We placed 600 masonry wells to our credit in this one year. If one has sub-divisional officers, who know their sub-divisions well, people can be induced to take advances where otherwise they would not.

48. *Q.* (*Sir Thomas Higham.*)—Did not they take advances in that year because it was a very dry year and they wanted employment?—It was largely as a species of famine relief.

49. *Q.* (*Mr. Muir-Mackenzie.*)—Still, if you had not put on the pressure,—actively endeavoured to induce them,—would they have done anything of the kind?—They would not be likely to at all to any such an extent as that.

50. *Q.* Can wells be put so close to each other that they will interfere with each other?—You can trust the people not to do that.

51. *Q.* (*The President.*)—I suppose you are not favourable to the introduction of canal irrigation from the Sardah?—Certainly not. They would be glad to be without it.

52. *Q.* You think it would do positive harm?—Yes.

53. *Q.* In what way?—It would raise the water level too dangerously near the surface.

54. *Q.* (*Mr. Muir-Mackenzie.*)—Mr. Moreland said the water was from 25 to 60 feet?—Anything over 30 would be exceptional and not worth attempting to classify.

55. *Q.* (*The President.*)—Your district is on both sides of the Goomtee?—Yes.

56. *Q.* Do your remarks apply as much to one side as to the other?—Yes.

57. *Q.* One of our witnesses told us that the objection to the Sardah Canal in Oudh really arose from the combined feeling of the taluqdars. Do you believe in that?—I do not think Sardah Canal project has ever been within the range of practical consideration in Sultanpur, and that is the only place where I know the taluqdars well. Land which had grown sour from previous wet years recovered from the dryage of 1896-97. A dry year is often a blessing in disguise to land like that.

58. *Q.* That could be provided by drainage in wet years and irrigation in dry?—It is dangerous to interfere with Providence. They have done it in Aligarh and over-drainage there is now said to be one of the causes of the sinking of the water-level in the western part of the district.

59. *Q.* (*Mr. Muir-Mackenzie.*)—It may be the dry years?—It is the primary cause, but when you add supplementary causes, you get a result which would not have occurred only through dry years.

60. *Q.* Is not the conclusion that you can only judge from normal years?—None of us are in a position to say anything certain. Our ken is only 10 or 20 years. The causes are spread over a great deal more than that time.

61. *Q.* (*Sir Thomas Higham.*)—You find in Aligarh and Mainpuri districts, irrigated by the Ganges Canal, that the canal irrigation has caused a great many wells to be abandoned?—I found that in some cases in Mainpuri, and not in Aligarh. The ground is so well reached by canal water that in the canal tracts in Aligarh there is not much incentive now to make masonry wells.

62. *Q.* Are the old wells abandoned to take canal water?—Nobody who could get canal water would keep up his well. They are too lazy to work the wells, if canal water is available.

63. *Q.* Except that they have to pay for the canal water?—Yes, but it is so much easier.

64. *Q.* Has there been a decrease in the number of wells owing to the introduction of canal irrigation?—They had canals at the last settlement, 30 years ago, in Aligarh.

65. *Q.* (*Mr. Muir-Mackenzie.*)—They still have a large area in Aligarh. I suppose that is in parts not reached by the canal?—Half the district is well reached by canal water, and half is not, and that is why there is so much shown as watered by well. The well-irrigated area is considerably more than double the canal irrigated. Then they must be still using wells. There is always a great incentive to make wells in a rich district like Aligarh. If they have the money there is nothing they like better, unless the canal water is absolutely beside them. It is one of the best means they have of commemorating their names.

66. *Q.* Besides that, when they are on the tail of a distributary, to assure themselves of the supply of water?—Very probably, but I have not gone into it.

67. *Q.* (*Sir Thomas Higham.*)—Can you say that the spring level has risen as compared with the previous settlement in Sultanpur?—I have no figures.

68. *Q.* There is a large area of swamp land in Sultanpur. After the dry year of 1896 were not they able to cultivate *rabi* crops on these swamps?—In 1896-97, as in former famine years, you would find a *jhil* that perhaps you could not see across in ordinary years cultivated with *rabi.*

69. *Q.* In that respect they got a larger area than usual?—We sowed 75 per cent. of our normal area, but it was only by going on giving advances till we got them to sow. It must have been irrigated to start with; the ground must have been worked by masonry or earthen wells in order to get a crop into the land at all.

70. *Q.* In ordinary years they get *kharif* crops in those swamps?—Not where the swamp is large, but in the low-lying land not absolutely in the swamp they grow rice.

71. *Q.* There was no rice in 1896?—Very little.

72. *Q.* Was there a great falling off in your cultivated area in 1896-97, or was the scarcity due to high prices?—I do not suppose there was much fall in the *kharif* area sown, but a great fall in the outturn of the *kharif,* and we sowed 75 per cent. of the normal *rabi.*

73. *Q.* There was agricultural employment in the district?—Yes, we got a great many people to grow *sánwán* or *chena,* which I look upon as the best famine crop that can possibly be encouraged. It is the smallest of the millets. Brahmans and everybody will eat it. I have had a Brahman growing it, and he had never seen it in his life before. It keeps the people employed watering and weeding it, and it is ready to eat in eight weeks. Five crops can be sown in a year, and it is most prolific and very cheap. For four annas you will grow enough to keep a small family for a couple of months.

74. *Q.* If the Sardah Canal was carried into Sultanpur, what would be the result?—Many of the wells would collapse; earthen wells generally, and many of the masonry.

75. *Q.* Would the people take canal irrigation and let all their wells go?—It is hard to say. If the canal were brought to their doors, I fancy they would use it.

76. *Q.* It would depend on the rate that they had to pay?—Perhaps.

77. *Q.* And what the cost of lifting is?—Yes.

78. *Q.* (*Mr. Muir-Mackenzie.*)—You say that it was that rain in January 1897 which saved the situation?—Yes.

79. *Q.* Could you not have gone on irrigating from earthen wells?—It would have been a poor outturn.

80. *Q.* If that rain had not fallen, canals would have been the only thing that could have saved you in that year?—I very much doubt that the canal would have done so, because you have to predicate that it would have enough water for all that area sown, and I do not think it would have.

81. *Q.* But a canal with water is the only thing that would have saved you?—If we had a canal, and had had that fall of rain, the crop would probably have been ruined.

82. *Q.* That fall was fairly general?—Yes.

83. *Q.* Have you heard of it ruining any of the crops in the canal district?—I was only in Sultanpur.

84. *Q.* In some of the canal districts people made their fortunes?—In recent years these canal districts have suffered from heavy winter falls, and our outturns have been bad. If it was so in an ordinary year like this, it probably would be so in a year like that.

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85. *Q.* Do you think the deleterious effect of raising the water-level could not be corrected by drainage in Sultanpur?—I do not think so.

86. *Q.* Why?—It would be very hard to supply all the *jowar* and rice cultivation with water now met by the swamps, and drainage would send down the water-level.

87. *Q.* Your canal would balance it; would it not?—Well, we have the natural drainage channel in the district now,—the Goomtee.

88. *Q.* Do people convert their *kachcha* wells into *pakka,* or is the operation of making a *pakka* well quite independent of a *kachcha* well in Sultanpur?—You find *kachcha* and *pakka* all together, but if the tract is a bad one for *kachcha* wells, they will only be made in a bad year.

89. *Q.* In the tracts where *kachcha* wells are habitually made, is it a benefit to have them replaced by *pakka* wells?—Not if the *kachcha* wells last 15 or 20 years. Some last very well indeed.

90. *Q.* Can you say that the *kachcha* wells throughout a broad tract will generally last for that period?—No; there is always a risk.

91. *Q.* If a man makes a *pakka* well, he obviates that risk. Would it not be beneficial to replace *kachcha* wells by *pakka* wells?—Certainly.

92. *Q.* This Rs. 80,000 represents advances for *pakka* wells principally to tenants?—I cannot say now. There is a large tenant proprietorship and big co-sharing communities, and the line between tenants and proprietors is vague.

93. *Q.* What I want to get at is, how far it is possible to advance to a tenant who has no landed security to give. Was a considerable amount advanced to them?—I should say the tenants got a fair share.

94. *Q.* Have you any idea of how the security difficulty was got over?—Largely by taking joint security.

95. *Q.* A tenant and zamindar, or a number of tenants?—I cannot say. The small tenant in Oudh has had more security of tenure than the small tenant elsewhere.

96. *Q.* (*Mr. Roberts.*)—But that is not a thing he can sell?—I really forget now how the security was taken. I fancy you would find that the whole was recovered.

97. *Q.* (*Mr. Muir-Mackenzie.*)—I wanted to know how you satisfy yourself as to the solvency of your people?—We were very easy about that.

98. *Q.* If Government were desirous of encouraging the construction of *pakka* wells in future, do you think it might venture to be a little easier in ordinary years in the matter of security?—It is very largely a question of the personal equation. If the Collector wished his Sub-divisional Officer to grant advances for wells, the latter could no doubt induce people to take advances, who otherwise would not do so. But officers have not time now-a-days to do such work themselves.

99. *Q.* He will find no difficulties about recovering?—No.

100. *Q.* He may have to use discrimination and rely on personal character and on matters not easily estimable on paper?—Yes. He knows the people himself. But it is no good for him to write to the tahsildar, who, may be, without moving out of the tahsil, will give a reply. I think that Government might make wells itself in tracts where wells are very expensive, and, by a water-rate, recover the interest on the outlay. I would like to see it tried in places. These wells could be either put in charge of the Irrigation Department of the Department of Public Works or the District Board. The people would willingly pay a water-rate sufficient to recover 4 per cent. annually.

101. *Q.* You are familiar with some of the objections. They are exceedingly expensive?—Yes, I know. But all expense of that kind is infinitely recouped by a good crop, and by the good feeling which such a system would promote amongst the people.

102. *Q.* Could not the expense be avoided in any way?—One ought never to do for anyone what he can be got to do for himself. If one can induce a man to take *takavi* and put in his own money towards the making of the well, it is far better.

103. *Q.* Could not the Government make a grant for the well, getting the man to make it himself and taking interest in the form of a water-rate, but not attempting to recover the capital at all?—Yes, if it were arranged that the water-rate fell in in a certain number of years after which he might be considered to have repaid the capital. That would be a great inducement.

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104. *Q.* You prefer that to repaying a loan by instalments?—I do not know. I have never talked it over with the people. But I think it would be what they would prefer, and certainly worth trying.

105. *Q.* (*Mr. Rajaratna Mudaliar.*)—Subsequent to the famine have you had occasion to make any advances?—Yes, in Aligarh. In 1899-1900 for wells, Rs. 18,207; in 1901-02, nearly Rs. 15,000.

106. *Q.* Do you give it in instalments or in lump?—Generally in instalments according to the progress of the work.

107. *Q.* Would it be advantageous if the borrowers could make their first instalment of repayment two years after the completion of the well?—It does not much matter to them when they begin repaying.

108. *Q.* Do you remit any portion of the loan if he does not find water?—I have heard of no case like that.

109. *Q.* What exemption from enhancement do you give in the case of wells in Sultanpur?—According to regulations.

110. *Q.* Calculated on the area commanded, or the amount spent?—On the amount spent. There is no regular fixed rate. The rules for allowances were not considered fully until just at the close of the Sultanpur settlement. Then more liberal allowances were made.

111. *Q.* (*Mr. Roberts.*)—There was a large increase in the revenue in Sultanpur?—About 22 per cent. Government hoped for 33.

112. *Q.* So the settlement was a liberal one?—Yes. It is difficult to assess how far the rent is increased by virtue of any improvement.

113. *Q.* (*Mr. Rajaratna Mudaliar.*)—Does a landlord fully understand the rules?—I do not know, but I know that he asks for a great deal more than he could ever be entitled to. He is alive to the fact that there is exemption whether he or the tenant makes the well.

114. *Q.* In Aligarh there are more than 30,000 *kachcha* wells. What on a rough approximation is the area these wells irrigate?—A masonry well, with one bucket and a pair of bullocks, would irrigate over 5 acres,—at the outside 10; 12 with a couple of pair of bullocks. They are very big buckets, and generally very good bullocks, and if an earthen well were in good order, I suppose that it would do the same. So that a four-bucket well, costing Rs. 800 to Rs. 1,000, would cover from 20 to 50 acres according as one or two pair of bullocks are used for each bucket.

115. *Q.* The area shown as irrigated from these 30,000 *kachcha* wells and about 14,000 of masonry wells is 334,000. That is not too high?—No, because so many of these wells are two and four-bucket wells; occasionally six buckets or more.

116. *Q.* (*Mr. Muir-Mackenzie*)—You were talking about the landlords helping tenants to make wells. Some witnesses have said that landlords in Oudh are strongly opposed to the making of wells?—A big man might be.

117. *Q.* Why?—Because he knows that he might have to pay compensation when he turns the tenant out.

118. *Q.* It does not get him any very great increase in rent. I understood from Mr. Butler that there is practically no distinction between dry and wet?—In Sultanpur we had absolutely no distinction. The rent is a lump rent, and it is not differentiated according to wet and dry.

119. *Q.* The rate in Oudh always takes into consideration the capacity of the land for irrigation?—Very largely.

120. *Q.* Big landlords, who oppose wells, are not likely to make them themselves?—Probably not.

121. *Q.* (*Mr. Rajaratna Mudaliar.*)—There was no reason alleged. A cultivator sinks a well and also allows his neighbours to use it, and you treat the whole area irrigated as wet. The landlord gets nothing?—Yes, he does.

122. *Q.* (*Mr. Roberts.*)—Your settlement is based entirely on your estimated assets, and these are based on the actual rental, and where a field is rented at Rs. 100 you take Rs. 50?—We are supposed to.

123. *Q.* If the previous rental were Rs. 80, you would only have taken Rs. 40, and if, by wells, it was raised to Rs. 100, there is Rs. 10 profit to the landlord in any case?—Yes.

124. *Q.* In no case does Government get more than half of the increase?—Never; but the landlord always chooses to forget that.

125. *Q.* About the Sardah Canal it has been said that the tenants would be glad to get the water, but the taluqdars object because of the loss of influence by the tenants passing out of their control by the advent of Government officials to collect canal rates. Is the objection to the canal confined to taluqdars, or shared by the cultivating people?—Speaking for Sultanpur, I do not think that the question has assumed a position for practical consideration, and there cannot be objection if there is nothing to object to. I do not think the matter has ever been put before the taluqdars.

126. *Q.* We have been told that one of the difficulties of *takavi* is that there is a lot of extortion. Is there anything in that actually amounting to a deterrent?—There is leakage everywhere. It is not an actual deterrent. If people really want *takavi* they will take it. In a district like Aligarh there is no demand for it.

127. *Q.* Did that Rs. 15,000 all go to the men who borrowed it?—The bulk of it. Very little leaks. The people are fairly ready to complain of leakage. Only the other day a man complained of a *patwari* who was evidently a bad lot. But all one can do is to insist on a tahsildar or sub-divisional officer distributing the money himself. Last year the Assistant Magistrate distributed it with his own hand and that ensures, so far as any power on earth can, that there shall be no leakage. With the man of the stamp of tahsildar we are getting now, who chooses to take personal interest, there will be very little leakage.

128. *Q.* What about security for *takavi* with tenants having no transferable security?—You can get substantial occupancy tenants to combine, and I would be more lax in a bad year than another.

129. *Q.* But the tahsildar takes a strict view of his chances of getting the money back?—Then he must be instructed.

130. *Q.* As a matter of fact, do you find tahsildars disinclined to give advances because of difficulties in the way of security?—I do not find it so in Aligarh.

131. *Q.* Mr. Hand, of the Opium Department, was of opinion that all zamindars are opposed to tenants making wells. You agree with reference to big zamindars?—It differs so much. Some do and a great many do not. If a landlord refused permission, the tenant could appeal to the Collector.

132. *Q.* (*Mr. Muir-Mackenzie.*)—Would not the landlord make it very unpleasant for his tenant?—Yes, but the tenants have a great deal of backbone in Oudh.

133. *Q.* In these figures for Aligarh there is a great deal of variation in the amount of advance; what is the reason?—The series of dry years.

134. *Q.* In ordinary years *takavi* advances in Aligarh sink to nothing?—Unless it is pressed. Sub-divisional Officers paid some attention to it last year, and there was a good deal given. I find that Government is always ready to give as much as is required.

135. *Q.* Would it not be wise to make it prominent in ordinary years?—Certainly, but the personal equation comes in. People have so much to do now-a-days that unless they are specially pressed Sub-divisional Officers cannot spare the time.

136. *Q.* Does the rigidity of collection deter people?—It must do, but it is inseparable from regular administration. But in bad years I would postpone *takavi* freely and remit a good deal altogether. But, of course, that the people do not know when they borrow.

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WITNESS No. 55.—MR. E. B. ALEXANDER, Commissioner of the Meerut Division.

(*Replies to printed questions.*)

The one tract regarding which I feel competent to express an opinion is that comprising the Sadabad tahsil of the Muttra district and the Hathras-Iglas tahsils of Aligarh.

2. I saw a great deal of the Sadabad tahsil in 1883-84 after a period of drought, and I have seen a little of the Aligarh tahsils recently.

3. In the whole tract, but more especially in Sadabad tahsil, the potential irrigation from wells used to be much better 30 years ago than it is now.

The reason seems to be that in about 1880 after some years of heavy rainfall the drainage of the Kali Nadi was much improved, and rain water, which used to percolate very slowly through the surrounding country, was run off very much more quickly. The effect of these measures was to lower the water level some three or four feet even at a distance of thirty miles away from the *nadi*.

Added to this the effect of a cycle of years of deficient rainfall and the drop in the water level brought it down

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either into a stratum of loose fluid sand in which *kachcha* wells could not work, or into a stratum full of ammonia or other substances injurious to crops.

4. The extraordinary extent to which the quality of water varies in wells at quite short distances from each other in the Muttra district is a well known fact, and to considerable, though less extent, the quality of water will vary in the same well according to the depth to which the surface of the water sinks.

5. The whole tract is one which, in my opinion, calls most urgently for some extension of the canal system or for an entirely new canal.

6. I am afraid the amount of water available in the Jumna is not sufficient to make a new canal possible, and whether the present system could be extended so as to pass through this tract is a point on which I can express no opinion.

I can only say that it is extremely desirable that the extension should be made if it is possible.

7. No private enterprise—at least none which the local zamindars or cultivators can command—can supply the need; but, on the other hand, none of the other obstacles mentioned in question 1 exist as far as I am aware.

8. There is certainly a strong desire for it. The increase resulting in the value of produce would be very large, and I should say that an average water-rate of five (5) rupees an acre might be charged, and that Government would still reap a substantial advantage at the next settlement in the shape of enhanced revenue, as cultivation would extend and rents would rise even though the water-rate levied was five rupees an acre.

9. As regards the construction of masonry wells, the small size of the average tenant's holding and his want of means render him, as a rule, unable to incur the expense at any profit to himself. It is therefore to the zamindars that we must look, and unfortunately very few of them care to spend money in this way. If some power could be given to the District Officer (subject to proper checks) to insist on landlords constructing irrigation wells, or to have them constructed himself and enhance the Government revenue by a sum which would repay the expenditure *plus* interest within twenty years, I believe the policy would be a good one. The experiment could be tried at first in a few districts in which there are officers of experience, and the maximum cost of a well as also the number to be made in a given area or at one landlord's expense might be limited.

10. As regards tanks, such little experience as I have is not favourable. They seem to me generally to fail in a year of drought unless they are natural lakes of considerable size. Where, however, there are hills in which large reservoirs can be constructed, I can quite understand their being very useful. My remarks apply only to the common tank dug as a famine relief work which, though it is often useful as retaining enough water to keep the village cattle alive, is seldom of appreciable use for irrigation.

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1. *Q.* (*The President.*)—Do you think Mr. Brownrigg's feeling that, in a wet year, when there was no interest in irrigation, the canal was not only negative, but was doing positive harm, is warranted?—Some time ago when canal distributaries were taken out across drainage, no doubt that did do harm; but that has been rectified. I do not think any harm would result now even in a year of heavy rainfall.

2. *Q.* In answer to question 3 you say—"In the whole tract, but more specially in Sadabad tahsil, potential irrigation from wells used to be much better 30 years ago than it is now," due to the Kali Nadi?—That was the popular impression; a large number of irrigation channels were made in the Aligarh District and the Kali Nadi was straightened and deepened, and that happened before the fall in the water-level took place, and popular opinion attributed the latter to the channels and the general drainage in Aligarh.

3. *Q.* My recollection is that we deliberately stopped the extension of irrigation, because it was interfering with wells?—Yes. I remember that. The people did not want it brought down to Sadabad; the channel had been taken through part of Muttra District and was abandoned.

(*Mr. Muir-Mackenzie.*)—Is not that an example of the original mistake of refusing water to a well irrigated tract?

(*The President.*)—I think it is. There is no doubt that the water-level has fallen enormously. It used to be 35 or 40 feet and now it has gone down to something like 70 or 80.

4. *Q.* You say in reply to question No. 8—"There is certainly a strong desire for it (irrigation). The increase resulting in the value of produce would be very large, and I should say that an average water-rate of five rupees an acre might be charged, and that Government would still reap a substantial advantage at the next settlement in the shape of enhanced revenue, as cultivation would extend and rents would rise even though the water-rate levied was five rupees an acre." Do you think that the canal water-rates are too low that they might well be raised?—Where they are newly introduced. You could not very well raise them where you have had them a long time and rents have adjusted themselves accordingly.

5. *Q.* The full value of the irrigation is being got in the Revenue Department instead of in the Public Works Department; the assessments have been raised in consequence?—Yes, but the landlord gets half the increase in rent. He would not get any of the water-rate.

6. *Q.* (*Mr. Roberts.*)—Would not a rise in canal rate be followed by a fall in rents?—It might be, but the tenants would suffer before that happened, *i.e.*, in tracts where the low rates have been in force some time and rents have been adjusted on this basis.

7. *Q.* (*The President.*)—In reply to question 9 you say—"If some power could be given to the district officer (subject to proper checks) to insist on landlords constructing irrigation wells, or to have them constructed himself and enhance the Government revenue by a sum which would repay the expenditure *plus* interest within 20 years, I believe the policy would be a good one." You think that the present facilities for *takavi* are not sufficient?—The cases I was thinking of were rather those where you have a lot of occupancy tenants with no very large holdings, men of no great substance who could not afford a *pakka* well, and where the zamindar simply will not build one because they are occupancy tenants.

8. *Q.* Is Government over-particular about security with these occupancy tenants?—Yes. I agree with Mr. Brownrigg that Government, in some places where a well can obviously be made, because wells have already been made and worked, might freely put in money there and charge a water-rate. In the same way I think it might lend money to occupancy tenants without very much security.

9. *Q.* The district officers must be able to form an estimate of the character of the tenants as to whether they are likely to pay up?—Yes, but the constant changes of officers are rather against it.

10. *Q.* You distinctly advocate an extension of wells where that can be done as a famine protection?—Yes. There is certainly a possibility of making more wells. I never saw any Court of Wards estate which did not require more wells than were in existence when it came under charge. The great bulk of wells are made by zamindars for their own land—*Khudghast* and others by zamindars with non-occupancy tenants from whom they get enhancements easier. The places where there are occupancy tenants are where wells are wanted as a rule. I do not think that it would be safe to make them experimentally in tracts where the expense is likely to be considerable, because the Government would probably lose its money, but where there are wells still working and it is only a matter of giving more at a moderate cost, they might be made with advantage.

11. *Q.* Do you think that many men make a bad shot at a well?—Over this tract it was extraordinary to see the difference in the distance of the water and you might have one well with perfectly sweet water and 200 yards away you would have another with bitter water. Borings would give a certain guide. I have used the boring tools of the Agricultural Department.

12. *Q.* Is there a large demand for them?—I believe it is increasing, but I do not suppose it is a large demand.

13. *Q.* Enough to keep such materials at the head-quarters of each district?—Not every district, but where *pakka* wells are habitually made, yes.

14. *Q.* Would it be judicious on a canal like the Ganges to restrict the area to be watered in a village?—Is mischief done by over-watering?—In Meerut and elsewhere we are told that 70 or 80 per cent. of the land is now watered every year. We have had a sequence of dry years, and nothing of that sort would be advisable now, with a cycle of wet years extensive canal irrigation might aggravate a rise in the water level, and with it the efflorescence of *reh* on the surface. A restriction of canal irrigation might then be temporarily advisable.

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15. *Q.* People say the irrigated lands are not half as protected as they used to be. Is there anything in it?—It is a matter of wet and dry years again. Now after a cycle of dry years the demand for water is enormous, and the duty much increased, hence the complaints.

16. *Q.* Is there any artificial manure used in these parts for constant waterings?—Yes, but the indigo refuse which was very largely used in many places is much scarcer now than it used to be owing to the decline in the manufacture.

17. *Q.* (*Mr. Muir-Mackenzie.*)—With regard to the security question, supposing tenants were given a good long period in which to repay, would not a crop be sufficient guarantee for the annual instalments? - They could give the tenant 30 years?—The difficulty with the tenant is his liability to get into arrears with his rents and be ejected, and if he were a dishonest man, he might give a relinquishment.

18. *Q.* He would not give up land on which he had built a well if he could help it?—No, I do not think he would, but the holdings are very small, and you would have to deal with more than one man's holding irrigated from the one well. If you took joint responsibility, then the crop might be enough.

19. *Q.* Would it be difficult to get joint agreements?—That is the difficulty; they are rather suspicious of each other.

20. *Q.* Could more be done in the way of general advances if officers went in for a policy of active inducement, such as Mr. Brownrigg described?—Yes.

21. *Q.* Would you advocate such a policy or wait upon the demand?—It is best to wait upon the demand except in a few cases where you might put a certain amount of pressure on the zamindar to induce him to make wells where they ought to be, but are not made.

22. *Q.* If you wait upon the demand, the *takavi* advances for Aligarh would be about Rs. 3,000 or Rs. 4,000 a year?—I should like Government to have the power to make wells in some cases, as I have said before.

23. *Q.* In addition, would it not be a good thing if a policy of active inducement were entered on in order that in Aligarh you might increase the amount of your advances?—You could increase it, but your active tahsildar would make people who did not want to take money.

24. *Q.* But your active Sub-divisional officer?—Yes, but they change so often that you might have to fall back on the tahsildar.

25. *Q.* Would it be worth while to have a more or less permanent man in districts where there is scope for well construction?—As a rule, the people have got a great number of wells already made in such tracts.

26. *Q.* You do not think that any active policy of inducement would succeed?—Not unless you had some power behind it to make the people think that if they would not do it Government would do it for them.

27. *Q.* You would like Government to make wells in well tracts, but not to see experiments made in less promising places?—The people know enough about wells, and it is not necessary to find out more about them; but if a man was willing to go to the expense of making experiments, Government might help him; I would not put it all on Government.

28. *Q.* Government is apparently not unwilling to make a canal in an unpromising tract in the hopes of something coming of it, and what I hope to get your opinion for is that it would not be unwise to make similar ventures for wells?—The people know a great deal about wells; the canal experiments they cannot make for themselves.

29. *Q.* (*Mr. Rajaratna Mudaliar.*)—Why are the landlords so indifferent about the construction of wells?—Some are on good terms with their tenants and some on bad.

30. *Q.* Under existing conditions, does it pay landlords sufficiently to make wells?—In many cases the well which was made 20 years before, and from which their land was irrigated is now falling in, and the tenant is paying a rent fixed when the well was in full work. The zamindar is not losing anything by the well falling in; the tenant is, and though one would naturally expect the tenant to apply for abatement of rent he practically very rarely does so. The number of cases of abatement of rent is extraordinarily few; not one to a hundred of enhancements.

31. *Q.* Does it pay a landlord to spend large sums in constructing new wells?—That would depend upon his relations with his tenants. If he had non-occupancy tenants, he would probably make wells.

32. *Q.* But even in the case of occupancy tenants he can enhance his rent?—That depends on whether the tenant is already paying a wet rate.

33. *Q.* I mean where there are no wells?—Yes, he could enhance the rent, but the cases I refer to are those where there is bad feeling between the zamindar and tenant and the possible enhancement would not in such cases be a sufficient inducement, especially as some of the tenants might refuse to use the well even if he made it.

34. *Q.* The landlord now enjoys a period of exemption?—In Aligarh Rs. 2 per acre were generally let off on area newly irrigated from wells constructed since the last settlement.

35. *Q.* At the end of the exemption period the landlord gets only half the increase and the other half goes to the Government?—If the well is still working at the end of 30 years.

36. *Q.* That is on private improvements effected by the landlord?—Government and landlord get half each. The tenant is the man who pays.

37. *Q.* Would it be an inducement to the landlord if the Government share in the increase were given over to him?—You cannot do that after a period of 30 years, because not the well only, but the change in prices and a hundred other things which affect the assets have to be considered.

38. *Q.* But the landlord has spent the capital and should be allowed to receive the full benefit of it?—Yes, and perhaps Government think that after 30 years he has received the full benefit.

39. *Q.* But after that period, a certain portion of the enhancement would still be on account of the landlord's improvements?—If the well is still working.

40. *Q.* Assuming that, why should Government get a share of that enhancement? If that portion were surrendered to the landlord, would it induce him to make more wells?—I think 30 years is a sufficient inducement, and I do not think the enhancement due to the well can be separated then.

41. *Q.* (*Mr. Roberts.*)—A landlord is not entitled to all the benefit; all he is entitled to is to get a reasonable profit from his improvement. He is only co-sharer with the Government after all in the land?—I think the 30 years' term is quite sufficient.

42. *Q.* Is that term sufficient to recoup him?—It ought to be.

43. *Q.* If so, is that all he is entitled to?—Certainly.

44. *Q.* (*Mr. Muir-Mackenzie.*)—Do you know whether Moradabad suffered much in 1878?—Not very much.

45. *Q.* Is there anything to prevent a similar distress as in 1878 occurring again in Rohilkhund generally? The well irrigation is not large. There seems to be no idea of extending canal irrigation in Rohilkhund. Are you satisfied with that?—I do not know what would be possible myself.

46. *Q.* If a canal were brought into the tract, would it be a good thing?—Yes. There was a little experiment made in 1896 in Bareilly District. The zamindars used to make a *bund* across the river, but they gave it up, as they could not agree among themselves, and I wrote to Mr. Coles and the Irrigation Department took it up, and made the *bund* on behalf of Government and it irrigated a considerable area. That was a small experiment, about 3,700 acres, at a very small cost.

47. Q. But in 1877-78 the mortality was very considerable in Rohilkhund?—There was a certain amount in Moradabad due to famine, but not much.

48. *Q.* (*The President.*)—From my figures in the district of Bijnor where the canal is on a very small scale, 12,081 acres were watered in 1878-79 and now there is 25,763, and in Bareilly in 1877-78 there were 30,676 acres and in 1896, 129,083. Do you consider the administration of the Canal Department satisfactory as regards meeting the wants of the people?—Yes, on the whole. Sometimes when distributaries are altered there are individual hardships, because some whose holdings were irrigated do not get the same amount through the new channel. That wants looking into a little more.

49. *Q.* Do complaints come up often to that effect?—There are complaints, not often.

50. *Q.* Do you have any complaints about incorrect measurement?—Very seldom.

51. *Q.* Do the native Deputy Magistrates do their work fairly well?—Yes.

52. *Q.* Are famine relief programmes kept up in your division?—Yes, but it is a division so well protected that

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we have really very little we could do. The large tanks we have down on the list of the Aligarh District, about ten tanks each to cost Rs. 56,000, will not be the least good, because they would not hold sufficient water for irrigation purposes in a dry year. The programmes are kept up, but it is difficult to get any works of real permanent good.

53. *Q.* Do the programmes come up to you?—The village works ones do.

54. *Q.* And there is some effort to keep them up to date?—Yes; changes every year.

55. *Q.* (*Sir Thomas Higham.*)—What are provided for as village works?—The digging of small tanks, which would keep the cattle alive are useful works, but a big irrigation tank would be a failure; nine cases out of ten.

56. *Q.* These are practically the only village works?—And a certain amount of road work and filling in of insanitary holes and levelling mounds in some places.

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WITNESS No. 56.—MR. J. H. IVENS, Superintending Engineer, 1st Circle, Irrigation Works.

(*Replies to printed questions.*)

A.—GENERAL.

1. (i) The answers below refer to the eastern portion of the Upper Ganges-Jumna Doab served by the Ganges Canal, comprising parts of the districts of Saharanpur, Muzaffarnagar, Meerut, Bulandshahr, Aligarh, Etah, Mainpuri, Muttra and Agra.

(ii) I have become acquainted with the tract during 16 years of my service on the Ganges Canals.

2. The following is the average rainfall in each month for over 20 years at the stations noted :—

Months.	Hardwar.	Roorkee.	Deoband.	Muzaffarnagar.	Meerut.	Ghaziabad.	Bulandshahr.	Khair.	Aligarh.	Iglas.	Mat.	Sadabad.	Jalesar.	Gopalpur.	Kasganj.
January	1·94	1·76	1·48	1·37	1·07	·70	·64	·52	·67	·47	·36	·41	·57	·50	·55
February	·84	1·22	1·25	·85	·57	·29	·51	·30	·42	·25	·21	·16	·04	·06	·21
March	·85	·72	1·07	·97	·75	·53	·47	·33	·58	·36	·29	·33	·59	·46	·58
April	·11	·42	·30	·42	·45	·26	·19	·11	·12	·11	·19	·04	·01	...	·06
May	·87	·86	·83	·97	·73	·45	·68	·55	·48	·30	·47	·18	·22	·30	·46
June	4·59	4·71	3·23	2·94	2·94	1·79	2·76	2·13	2·66	2·29	1·88	1·76	3·00	3·62	2·78
July	12·35	12·45	10·64	10·36	9·14	7·29	8·97	7·73	8·94	7·04	8·37	8·59	9·06	9·54	9·55
August	15·93	13·59	8·39	7·57	8·76	7·05	8·14	6·53	7·56	6·49	6·21	6·99	8·70	9·71	8·38
September . . .	9·25	7·17	5·43	5·41	4·79	3·96	5·11	4·11	5·03	3·82	4·03	3·91	5·49	4·23	4·23
October	·57	·43	·33	·50	·49	·27	·63	·39	·72	·58	·40	·82	·14	·59	·71
November . . .	·12	·16	·07	·08	·03	·02	·02	·04	..	·02	·02	·03	·08	·04	...
December . . .	·23	·33	·35	·34	·46	·37	·56	·28	·34	·24	·25	·27	·10	·04	·24
TOTAL .	47·65	43·82	33·37	31·78	30·18	22·98	28·68	22·74	27·52	21·94	22·68	23·49	28·00	29·09	27·75

The following points are of interest with regard to this rainfall :—

(*i*) The fall at Hardwar and Roorkee is above the average, because of the position of these stations at the foot of the hills.

(*ii*) The average rainfall of Ghaziabad is 7·20 inches below that of Meerut, distant only 30 miles; this lower rainfall is probably due to the situation of Ghaziabad on the east bank of the Hindan Nadi, 12 miles above the junction of the Nadi with the river Jumna.

(*iii*) The rainfall over the tract of country in the districts of Aligarh and Muttra, lying between the Karwan Nadi and the river Jumna above the confluence of the two streams, averages 4·81 inches less than that at the station of Aligarh, from which the tract is from 10 to 35 miles distant. The deficiency at each of the four stations in this tract given above is as stated below :—

	Inches.
Khair	4·78
Iglas	5·58
Sadabad	4·03
Mat	4·84

The causes for this deficient rainfall are difficult to ascertain, but the extensive bare *usar* plains of the Mainpuri, Etah and Aligarh districts lying for 80 miles on the east side of this tract, may have something to do with it.

3. There is no obstacle to the extension of irrigation on the tract referred to arising from :—

(*i*) Sparsity of population.

(*ii*) Insufficient supply of water.

(*iii*) Insufficient supply of manure.

(*iv*) Unsuitability of soil to irrigation, except where *usar* is prevalent.

(*v*) Uncertainty of the supply of water.

(*vi*) Lack of capital for initial expenditure, or of funds for the more expensive cultivation of irrigated crops.

(*vii*) Fear of enhanced rent or revenue assessment.

(*viii*) Uncertainty of tenure or defects of the tenancy law.

(*ix*) But the extension of irrigation to portions of the Saharanpur, Muzaffarnagar, Meerut, Bulandshahr and Aligarh districts through which the Ganges Canal now runs is not recommended because they are rather over-irrigated, specially in low-lying tracts; it might be beneficial to restrict the irrigation somewhat in this area and to extend it to good land lying in the eastern portion of the Muttra and the western portion of the Aligarh district, where water is greatly needed because spring level is from 50 to 110 feet below ground surface, many of the wells have run dry, and their masonry linings cannot be sunk deeper.

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In the eastern part of the Bulandshahr district between the Ganges Canal and the Anupshahr Branch the soil is a compound of an inferior sandy clay mixed with salts, locally called *seota*, and spring level is only some 15 feet below ground level. The extension of irrigation to this tract might increase the deposit of salts on the surface of the ground, and cause some further deterioration of the soil; no extension can therefore be recommended to this part of the country.

The Aligarh, Mainpuri and Etah districts have such large areas of *usar* soil that any extension of irrigation in such tracts is not recommended.

4. Land irrigated from privately constructed wells or tanks is not usually exempted from enhancement of rent in the case of tenants-at-will, but is exempted until the next settlement in the case of occupancy tenants. Assessments are not enhanced until a settlement is renewed.

Any exemption from enhancement of assessment is secured in practice during the currency of the settlement, but the landlord derives the benefit of any work he constructs by increased rents charged to tenants-at-will. Exemptions from increased rent are secured by mutual agreement, or by the decree of an authorized revenue court.

Landlords usually exempt from enhancement of rent, such tenants as construct wells at their own cost for a period of from 5 to 15 years; but no exemption is made for purchasing means of lifting water or for making water-courses.

The existing exemptions are liberal when the period of currency of the settlement is sufficiently long; the new Tenancy Act provides in some measure for this.

It would be well to provide means to secure exemptions for a period of 15 to 20 years if possible.

5. Loans under the Land Improvement Act are not freely taken for the extension of irrigation, as there is little necessity for their being taken in the portions of those districts through which the Ganges Canal flows. Elsewhere the reasons are that there is little necessity for them, that people cannot use the money obtained from the loans in any manner they like, and the more influential landlords and *mahajons* do not encourage the loans being taken; under the new Tenancy Act they will probably be more freely taken. The punctual repayment of the loans is also a bar to their being taken freely; the terms are also considered hard, and it is often difficult to obtain the requisite security.

Of the methods proposed to encourage the loans being taken:—

(*i*) reduction of the rate of interest,

(*ii*) remission of the interest,

(*iii*) partial remission of the advance,

are not likely to encourage their being taken more freely as the advantages are only prospective.

(*iv*) Total remission in the case of failure to get water will, however, do much to encourage people to take the loans.

(*v*) Extension of the period of repayment will also remove many hardships.

(*vi*) Grants-in-aid will be of great benefit to the people and restore their confidence.

6. The extension of irrigation does not injure the remaining cultivation to any great extent by attracting cultivators to the irrigated tracts, except in years of drought. During the last decade there have been two famines during which some emigration took place from the eastern portions of the Muttra district; and a colony of Punjabis, with their flocks and herds, settled down in the comparatively sparsely populated pargana of Shikarpur in the Bulandshahr district.

During the past decade the population of the extensively irrigated Bulandshahr district has increased by 19 per cent.

The people in the Mat, Mahaban and Sadabad parganas of the Muttra district, and in the Gorai pargana of Aligarh, are eager to have canal irrigation extended to them, and a project for a canal to serve this tract has been prepared; a distributary is also under construction to the neighbourhood of Ghaziabad, and another is projected for the Tappal pargana of the Aligarh district.

B.—CANALS OF CONTINUOUS FLOW.

7. Irrigation increases the value of the produce of land:—

(*i*) By rendering it possible to cultivate two harvests instead of one. The most commonly raised double crops are the following:—

Wheat and indigo.

Indigo and millets.

Rice and peas, rice and gram, or rice followed by barley and peas.

Chari and gram.

Indigo and gram.

Cotton and gram or peas.

Several crops of maize. I have seen as many as three crops grown on the same ground in one season.

Maize and barley.

Many crops of lucerne.

Many crops of vegetables.

(*ii*) By leading to the substitution of more or less valued crops for rains crop.

The Deoband, Anupshahr, and Mat Branches of the Ganges Canal are the most recently constructed. The increase in the area of more valuable crops irrigated from these branch canals during the last 20 to 24 years is shown below:—

			Acres.		Acres.
Deoband Branch .	Sugarcane	from	3,236	to	16,913
	Rice	„	4,758	„	9,092
Anuqshahr Branch .	Sugarcane	„	17,999	„	39,866
	Indigo	„	4,319	„	29,878
Mat Brauch . .	Sugarcane	„	473	„	3,680
	Indigo	„	1,281	„	5,960
	Cotton	„	1,462	„	5,600

At the tail of the Mat Branch in the Muttra district sugarcane is but little grown at present, millet being the prevailing crop in the season; but extensive preparations are being made to increase the area under cane.

(*iii*) By increasing the yield—

(*a*) The growth of such crops as melons, vegetables, sugarcane, cotton, lucerne, indigo, poppy and tobacco, is only possible by means of irrigation except in years of very ample rainfall; even in such years they are frequently irrigated when water is available, because the slightest drought either reduces the yield or kills the growing plant.

Sugar is an exception as the cane is very hardy, but more than one crop in two years is seldom grown on the same ground.

Cotton can also stand a long drought.

(*b*) In a year of scanty rainfall all crops require irrigation, except perhaps the millets, maize and hemp.

(*c*) In a year of drought all crops must have water, both for germination and while in course of growth.

8. The following is an approximate estimate of the increase due to irrigation in the value of the produce of certain crops:—

(*i*) On the average of a normal term of years—

(*a*) Sugarcane	Rs. 30	to 50
(*b*) Indigo	„ 10	„ 25
(*c*) Cotton	„ 10	„ 15
(*d*) Rice	„ 5	„ 10
(*e*) Maize	„ 2	„ 12
(*f*) Wheat	„ 7	„ 20
(*g*) Barley	„ 5	„ 15
(*h*) Gram	„ 2	„ 10

(*ii*) In a year of drought—

(*a*) Sugarcane	Rs. 40	to 80
(*b*) Indigo	„ 20	„ 35
(*c*) Cotton	„ 15	„ 25
(*d*) Rice	„ 15	„ 35
(*e*) Maize	„ 15	„ 30
(*f*) Wheat	„ 20	„ 40
(*g*) Barley	„ 15	„ 35
(*h*) Gram	„	„ 20

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9. (*i*) The average rates paid per acre on account of irrigation, excluding owner's rate, are the following:—

Crop.	Per acre. Flow.	Per acre. Lift.	Per.
	Rs. a. p.	Rs. a. p.	
Sugarcane and rice	6 10 8	3 5 4	Year.
Tobacco, poppy, gardens, orchards, vegetables, and waternuts	4 0 0	2 0 0	Crop, except gardens and orchards per half-year.
Indigo, cotton, and all *rabi* crops	3 0 0	1 8 0	Crop.
All other *kharif* crops	2 0 0	1 0 0	Do.

These rates are paid on the area actually irrigated.

(*ii*) Unirrigated land rents at Re. 1-8-0 to Rs. 3-12-0 per acre, irrigated land at Rs. 2 to Rs. 12 per acre; and in the neighbourhood of towns where vegetables are grown, at Rs. 15 to Rs. 50 per acre.

The rent is generally paid on the total area of the holding or field.

(*iii*) The owner of the land pays owner's-rate at one-third of the water-rate on the area actually irrigated, if the land is assessed at dry rates; if assessed at wet rates he pays a round sum on the whole area ordinarily irrigated; this sum is assessed at each successive revenue settlement.

10. The private expenditure per acre incurred in bringing water to the field and preparing the land for irrigation is approximately the following:—

Crop.		Lifting or distributing water.		Preparing land for irrigation.	
		Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Sugarcane.	Canal flush	0 4 0	to 0 6 0	0 4 0	to 0 8 0
Rice	Canal lift	3 0 0	„ 9 0 0	0 8 0	„ 1 8 0
	Well lift	9 0 0	„ 16 0 0	0 8 0	„ 1 8 0
	Canal flush	0 4 0	„ 0 8 0	0 4 0	„ 0 8 0
	Canal lift	3 0 0	„ 5 0 0	0 8 0	„ 0 12 0
	Well lift	8 0 0	„ 11 0 0	0 12 0	„ 1 8 0
Wheat, barley, etc.	Canal flush	0 4 0	„ 0 8 0	0 4 0	„ 0 8 0
	Canal lift	2 8 0	„ 5 0 0	0 6 0	„ 0 10 0
	Well lift	8 0 0	„ 11 0 0	0 8 0	„ 0 12 0

Canal water is generally lifted from 1 to 4 feet, and well water from 15 to 25 feet: the above figures are for these amounts of lift.

This expenditure is usually incurred by the tenant, who recoups himself by an increased outturn.

11. Some deterioration of soil has undoubtedly resulted from irrigation without manure; the upper portion of the Ganges-Jumna Doab is composed of such rich soil that little or no deterioration can be traced, and manuring is but little resorted to except in the case of sugarcane; rice is constantly and unnecessarily irrigated from the canal, as the fine silt brought down by the water has a very fertilising effect, and acts as a manure. In the lower portion of the Doab, about Aligarh, manuring is more extensively resorted to for all except rain crops; here the soil has always been poor and has undoubtedly been exhausted by too frequent cultivation.

Some deterioration of soil can also be traced in the Bulandshahr district from too profuse irrigation, which has caused the land to become soured; but this has been overcome by a much needed reduction of outlets carried out within the last ten years. In the same district the cause of a poor crop of sugarcane can generally be traced to too frequent irrigation while the crop is young. Evil results from too extensive irrigation only appear when water is used too profusely; this is the case in many low-lying village lands in the Aligarh district for which water is taken almost constantly; measures are now being carried out to reduce the evil by curtailing the irrigation in low lands and extending it to higher lying tracts.

Water-logging used to occur largely in the Muzaffarnagar and Bulandshahr districts, but the splendid system of drainage works constructed during the last two decades has almost entirely removed this evil, and new drains are dug every year to further reduce it. The mileage of drains now existing in the neighbourhood of the Ganges Canal is 1,701 to 3,097 miles of canal and distributaries. Much benefit has also been conferred by remodelling distributary channels and in removing them from low ground on to watersheds. Over half the total mileage of distributaries has been remodelled during the last decade.

Salt efflorescence causes much damage in the Aligarh, Etah, and Mainpuri districts; it is increased by careless irrigation done by cultivators, and by large volumes of water wasted on *usar* plains, but the damage has been minimized of late by the reduction and rectification of water-courses, and their proper repair by cultivators being more rigorously insisted on.

Irrigation from the Ganges Canal on the tract referred to has been going on for nearly half a century; the evils referred to above were at their worst about the seventies, but during the last 20 years they have been minimized by making drains, remodelling distributaries, reducing outlets, rectifying water-courses and insisting on their being kept in proper repair, constructing silt tanks, and preventing waste of water. The beneficial results of the work done are plainly discernible on all sides, and the evils are everywhere diminishing.

Drainage works are a necessary concomitant of irrigation works, the latter raise spring level by percolation, and undoubtedly cause water-logging even if correctly lined out on watersheds; canals should therefore be invariably accompanied by system of drainage.

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(1) *Extension, etc., of existing Irrigation Works.*—Are many extensions or improvements of existing works, which would be certain to prove remunerative or to increase the efficiency of the works, held in abeyance owing to restriction of funds?

(1) No, but extensions and improvements are delayed from want of establishment to prepare the projects; all Divisional and Sub-divisional Officers are busily engaged on current work, and have little time to spare to the preparation of projects. Again, the charge of many sub-divisions is held by subordinates, who, in many cases, are incompetent to prepare projects.

On the Ganges Canal there are six divisions in charge of Executive Engineers, and 16 sub-divisions, of which five are held by English Assistant Engineers, three by Native Assistant Engineers, seven by subordinates, and one by a Canal Deputy Magistrate. In former days it was the rule for a sub-division to be held by an Assistant Engineer, now it is rather the exception. In the Northern Division, where the work is of the greatest importance and responsibility, the three sub-divisions are held by Assistant Engineers; this leaves only five Assistant Engineers to be divided among the 13 other sub-divisions.

The life of an Assistant Engineer in the Irrigation Branch is very arduous and exposed, and the cost of living is greater than in the other branches of the Public Works Department. The men required should be specially keen, zealous, and interested in their work, of great tact and judgment to qualify them for the heavy executive and administrative work they have to perform, and to fit them to deal with native landlords and cultivators.

Canal Engineers are the most hard worked of all officers in India; they march about the districts throughout the year during the hot weather, rains and winter; the only closures of the canal occur in the rainy season, when all repairs to works below water level are carried out; towards the end of the rains distributary clearances are begun; and during the rains constant checking of rice irrigation is carried on. Canal Engineers have often to maintain three establishments, one for their wife at head-quarters, another to accompany them in the district, and a third in the hills for their children during half the year. They require ample means of locomotion and have to maintain carriage for their camp equipment throughout the whole year. This necessitates a heavy outlay, and in consequence married men suffer considerably from financial pressure. It also diminishes the attractiveness of the service, and we do not get the best men available. Most married men for these reasons try to get away from the Irrigation Branch into another, in which life is generally pleasanter and less trying.

Another reason for the lack of good establishment is the heavy demand made on the Irrigation Branch for men to serve elsewhere. A number of our most able men have gone to Egypt, where honours and rewards have been showered on them. Some have been lent to Native States, and to other departments. It is the best men who are asked for and leave, but the service naturally suffers in consequence.

The obvious remedy for this state of things is to appoint selected men of acknowledged administrative power, and great keenness for work to the Irrigation Branch, and to improve their pay and position in order to attrac the most suitable men to it, and to retain them contented with their work.

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(2) ***Financial arrangements.***—Have present arrangements under the provincial settlement the effect of encouraging or discouraging the extension of irrigation?

The effect is certainly to encourage the extension of irrigation. From conversations I have had with zamindars, it appears that the lavish use of manure and frequent ploughing, formerly only carried on for sowing wheat, has been advanced to other and inferior crops. Tenants-at-will do not now exhaust the soil in each successive season as they did before, but look forward to some extent to the future. They expect and endeavour to get a larger outturn from the crops on their land, and go in for a heavier initial outlay to obtain greater profits. The natural tendency is to irrigate the growing crops to ensure a good return for their increased outlay in preparations.

The rapid increase in the area of first class crops on tracts commanded by canals, such as edible sugarcane, ***paunda*** and ***merthi***, cane for pressing, ***dholu*** and *sorta*, and rice of the transplanted, deep-rooted, and shallow-rooted varieties has been very marked of late years; under the present provincial settlement this increase is likely to continue with far greater rapidity. The following figures show the average increase in areas of first class crops, irrigated from the three most recent extensions of the Ganges Canal at the beginning of the eighties and at the end of the ninetees—

Branch.	Irrigated area of 1st class crop in acres.		Remarks.
	1881-85.	1896-1900.	
Deoband . .	12,847	23,276	Rice and cane.
Anupshahr .	15,970	23,414	Cane only.
Mat . .	909	2,943	„

FIRST CIRCLE, IRRIGATION WORKS.

Statement showing the advance in irrigation and in the area of 1st class crops on the Deoband Branch, Northern Division, Ganges Canal.

Year.	Total area irrigated.		Area of sugarcane and rice.		Total.
	Kharif.	Rabi.	Sugar.	Rice.	
1881-82 . .	9,486	18,356	6,655	3,414	10,069
1882-83 . .	15,081	13,514	11,041	3,476	14,517
1883-84 . .	15,213	23,665	8,377	3,790	12,167
1884-85 . .	15,700	10,342	8,912	5,362	14,247
1885-86 . .	14,717	25,904	9,322	3,885	13,207
1886-87 . .	14,891	15,785	8,672	3,768	12,440
1887-88 . .	14,794	18,785	9,183	4,021	13,204
1888-89 . .	17,065	11,662	11,237	4,858	16,095
1889-90 . .	16,597	29,898	8,073	5,489	13,562
1890-91 . .	19,273	15,548	9,300	6,767	16,067
1891-92 . .	15,595	25,192	11,345	6,290	17,635
1892-93 . .	19,549	23,009	9,126	6,519	15,645
1893-94 . .	19,511	18,961	12,009	6,016	18,025
1894-95 . .	21,033	661	11,632	7,619	19,251
1895-96 . .	18,523	23,347	10,822	6,473	17,295
1896-97 . .	24,763	36,914	17,890	6,974	24,864
1897-98 . .	26,123	27,245	13,288	10,275	23,563
1898-99 . .	24,106	27,346	15,092	7,237	22,329
1899-00 . .	29,638	45,656	15,741	8,025	23,766
1900-01 . .	25,606	26,819	12,155	9,702	21,857
1901-02 . .	28,028	43,392	9,729*	10,817	20,546
TOTAL .	405,292	482,201	229,601	130,777	360,378

* Decline in sugar owing to injury from grasshoppers: the crop was ploughed up and other crops were sown in the rains.

(3) *Expansion of irrigation from existing works.*—Main features and results of the policy adopted during recent years for the expansion of irrigation from existing canals by remodelling the channels, re-adjusting the size and location of outlets, and improving generally the system of distribution. Further scope for similar improvements.

Most of the distributary channels of the Ganges Canal have been remodelled during the last ten years. The main features of the policy adopted for this remodelling have been to adapt the channels to command the country to be served in order to admit of flow irrigation being rapidly carried out; this has been done by giving the beds of channels more gentle slopes, with numerous small notched masonry falls suited to drops in the level of the country; to adjust the sections of channels at each mile to carry a volume of water sufficient for all requirements, in order to ensure that a portion of the supply at the head flows down to the tail outlets, without being all consumed in the upper reaches; to reduce the outlets to a number which can be all fed with the supply carried at each point of the channel; and to select the position of outlets to serve water-courses flowing through high ground to command tracts of cultivation on each side. By placing the outlets in the banks above notched falls, an excellent command of the country lower down can be obtained.

The slight slope given to the remodelled beds of channels has reduced the velocity of the water carried down; in consequence there is no longer any tearing action or scour of the bed and berm that used to exist everywhere. The result has been an automatic process of puddling the beds and sides of the channels, which makes the loss by percolation much smaller than it used to be; a large volume of precious water is therefore saved by low slopes. This morning (16th December), I rode up the Sikandrabad Distributary, a channel which has been recently remodelled to a bed slope of 1 in 6,600, after giving a good deal of trouble in the past. I found the channel closed, but saw that water had easily reached the tail minors at a distance of 24 miles from the head; both bed and berms were coated with a film of very fine silt, some 2 or 3 inches thick, which must form the most effective natural puddling possible. This fine silt appeared as if it had been plastered with a trowel, for there was not a sign of a ripple on the surface to be seen anywhere. The adjustment of sections of channels to suit the requirements at each point has led to a revolution in the distribution of water. Formerly all water was consumed with much waste in the upper reaches of channels; but little got down to the middle reaches; and scarcely any, or none at all, flowed to the tail where the outlets were starved. Now a portion of the water admitted at the head of a distributary reaches the most distant outlets, and every cultivator is able to carry out his irrigation with ease and rapidity.

A comparison of the areas irrigated from distributaries in 1877-78 and 1883-84 with those irrigated in 1896-97 and 1899-1900 is very instructive. The total area irrigated in the upper reaches of channels during the last two famine years has increased considerably; that in the middle reaches has almost doubled; and lower down in the channels an enormous and quite unlooked for area has been irrigated. This large area at the tail was unexpected; because water was formerly but occasionally obtained with difficulty in the lower reaches of distributaries, and cultivators necessarily learnt to use it with economy and without waste, in consequence they were taught to make water go much further for irrigation than elsewhere, by dividing their fields into smaller patches to be filled in succession, by using only the minimum amount required in each patch, and by keeping their water-courses in a better state of repair to prevent leakage.

The number of acres irrigated in each sub-division of the Anupshahr Branch during the last four years of drought illustrates the increase of irrigation in the lowest reaches of that channel:—

Year.	I Sub-divn.	II Sub-divn.	III Sub-divn.	Total.
1877-78	31,546	36,482	...	68,028
1882-83	38,824	62,941	39,692	1,41,457
1896-97	48,605	74,210	75,666	1,98,481
1899-1900	64,669	84,968	99,394	2,49,031

Outlets in the upper reaches of channels have been reduced to a number admitting of the required area being rapidly and easily irrigated without waste, and those lower down have also been slightly reduced to suit the requirements of each village; but reduction of waste has been almost entirely carried out by giving each channel a full

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supply of water for the time required to carry out its irrigation, and no more. The accompanying statement shows the reduction in number of outlets during the last ten years on the five principal distributaries of the Ganges Canal; with the exception of the Kalda Distributary, the reductions have not exceeded 25 per cent.

Statement showing number of outlets per mile of channel during the last 10 years.

Distributaries.	1889-90.	1890-91.	1891-92.	1892-93.	1893-94.	1894-95.	1895-96.	1896-97.	1897-98.	1898-99.
Right Muhammadpur	8·0	7·5	7 5	8·0	7·2	7·2	7·2	6·4	6.0	6·0
Parichatgarh	6·6	6·9	7·0	7·2	7·2	7·2	7·2	6·8	5·4	5 ·4
Right Jauli	8·0	8·1	8·1	8·2	8·6	8·2	8·2	8·5	8·1	5·5
Kalda	12·3	12·3	12·3	12·3	7·9	7·1	8·3	8·3	8·5	8 6
Somera	8·8	8·8	7·0	7·3	7·2	7·2	7·1	7·0	6·8	6·3

Outlets in salt lands, *usar* soil, have been removed to better ground, where the water-courses will not take up the salts and carry them into cultivation. Where distributaries are passed across low ground, water-courses with high banks are generally removed to better places in cutting, where less waste is likely to occur, or minors with suitable falls are made to replace them. Sometimes these high water-courses are found in such good order with constant silt clearance, and so well puddled with fine silt, that they are allowed to remain. A fruitful source of waste is placing outlets near roads; for this reason falls with deep drops are seldom combined with bridges, but separate notched falls are placed at a slight distance below roads.

A small book containing "Instructions on Repairs for the use of Canal Subordinates" has been recently printed, which is likely to prove of some use for the guidance of Sub-Overseers. In addition to notes on repairs, it contains other directions for the prevention of waste by crossing channel heads effectively, for placing outlets in proper positions and for the careful supervision of all irrigation matters. The result of all these arrangements for the use of water with economy and for the prevention of waste in the upper reaches of the channels which received a superabundant supply has been a large saving of valuable water; the volume saved is now utilised in larger supplies given to the middle and lower reaches of channels which formerly received but a scanty supply or no water at all. Almost every distributary and minor channel has been enlarged to carry increased supplies in order to allow irrigation to be easily and rapidly carried out without waste; in consequence, the total requirements for consumption in each division have increased. But, on the other hand, the actual volume available for consumption has been reduced. The Ganges Canal has now to furnish water for the Agra Canal, for which the river Jumna has generally an insufficient supply. The volume of water in the river Ganges at Hardwar and at Narora is now equally divided between the Upper and Lower Ganges Canals; during a part of the month of January 1900, the share of water available for consumption on the Ganges Canal on this basis was only 2,620 cusecs, with which over ¾ million of acres of irrigation had to be kept up. Formerly about 6,500 cusecs were available, that is all the water that could be admitted into the Ganges Canal from the river Ganges at Hardwar, 8,000 cusecs, less 1,500 cusecs that had to be passed down the Cawnpore Branch below Aligarh to keep up navigation. This 8,000 cusecs amounted to about three times the volumes available in January 1900. Within the last three years the Fatehpur Branch has been opened, which requires a supply of 600 cusecs of water; at present the Mat Branch Extension is under construction, which later on will require a volume of 412 cusecs, and the Nandgaon Branch for which 180 cusecs will be required. Without the great economies in the use of water brought about in recent years, and the better system of distribution on the principle of giving bountifully for short periods, it would have been impossible to entertain any idea of these extensions; yet the extensions are being made, and there is little doubt that with further economies, and with further investigations on the elasticity and better distribution of water, the required supplies will be obtained without any reduction whatever in the area irrigated from the Ganges Canal.

During the last decade there have been two record years of irrigation from the Ganges Canal, 1896-97 and 1899-1900; but in both years the volume available for consumption on the canal were far more scanty than those in previous record years.

The Aligarh Division is now the only backward one of the Ganges Canal; in it there is still scope for further economies in distribution, which are being attended to as quickly as possible in the endeavour to obtain a supply of water for pargana Hathras. But every day some new fact comes to the knowledge of the irrigation student, and constant changes and improvements are carried out in all divisions of the canal with a view to economise water.

(4) *Duty of water.*—Improvement effected of recent years in the duty of water. Probable percentages of supply at head of canal still lost by percolation, etc., from (1) main canal, (2) distributaries, (3) water-courses. Results of any experiments that may have been made with reference to the question of rendering the channels water-tight by puddling or otherwise.

The improvement effected of recent years in the duty of water in the Meerut and Bulandshahr Divisions can be seen from the following statement for the last four years of drought:—

Division.	Year.	Duty in season.		Duty whole year.	Remarks.
		Kharif.	Rabi.		
Meerut	1877-78	93	150	233	Supply unlimited.
	1883-84	60	137	192	" "
	1896-97	114	161	272	" limited.
	1899-1900	99	163	265	" "
Bulandshahr	1877-78	89	174	220	Supply unlimited.
	1883-84	141	195	340	" "
	1896-97	136	188	326	" limited.
	1899-1900	116	281	396	" "

The following statement shows the duty on five principal distributary channels of the Ganges Canal during the last nine years; the figures for the previous years from 1877-78 are not available.

Channel.	Mileage.	1891-92.		1892-93.		1893-94.		1894-95.		1895-96.		1896-97.		1897-98.		1898-99.		1899-00.		Average for 9 years.	
		Kharif.	Rabi.	Kharif.	Rabi.	Kharif.	Rabi.	Kharif.	Rabi.	Kharif.	Rabi.	Kharif.	Rabi.	Kharif.	Rabi.	Kharif.	Rabi.	Kharif.	Rabi.	Kharif.	Rabi.
Muhammadpur	62 6	82	95	84	98	93	83	82	1	65	74	78	89	84	47	60	49	73	79	79	69
Parichatgarh	85·7	80	128	81	95	75	95	60	...	58	90	82	122	78	112	85	97	100	139	78	97
Jaoli	55·0	71	97	66	96	68	82	68	17	67	94	97	111	78	82	64	93	89	140	74	91
Kalda	142·6	131	112	87	159	87	110	67	57	86	104	102	189	76	125	73	136	105	161	90	138
Somera	116·3	93	152	93	187	90	170	90	26	75	184	134	202	93	166	79	165	125	155	97	154

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Statement showing irrigated areas and duties in the Meerut and Bulandshahr Divisions, Ganges Canal.

Division.	Year.	AREA IRRIGATED.		TOTAL OF DAILY DISCHARGES UTILIZED.		NUMBER OF DAYS THE CANAL WAS RUNNING.		DUTY.		Duty, whole year.	REMARKS.
		Kharif.	Rabi.	Kharif.	Rabi.	Kharif.	Rabi.	Kharif.	Rabi.		
Meerut	1877-78	69,047	59,731	135,629	66,093	183	166	93	150	223	Unlimited supply.
	1878-79	66,412	102,304	88,488	96,320	150	170	113	180	292	Ditto
	1883-84	84,024	171,418	257,749	228,917	183	183	60	137	192	Ditto
	1896-97	78,859	157,210	127,108	190,100	183	182	114	151	272	Limited supply.
	1899-1900	94,848	185,906	142,958	207,537	149	182	99	163	265	Ditto
Bulandshahr	1877-78	85,528	62,473	174,590	59,583	183	166	89	174	220	Unlimited supply.
	1878-79	88,837	122,561	141,361	164,884	150	170	94	126	221	Ditto
	1883-84	88,466	139,120	114,641	130,287	183	183	141	195	340	Ditto
	1896-97	94,080	147,380	126,517	143,628	183	182	136	188	326	Limited supply.
	1899-1900	106,297	202,067	136,612	120,942	149	182	116	281	396	Ditto

From calculations made on the volumes entering the Ganges Canal and those consumed or passed on, it appears that the loss by percolation on the canal varies from 13·1 to 16·2 per cent. of the supply taken in at Hardwar. The loss is greatest in proportion where the canal is raised rapidly, and is least where a medium supply is run. The loss by percolation on some distributaries has been found to be from 6·8 to 8·2 per cent. of the volumes at the head. Experiments on the loss from percolation, etc., on water-courses was begun in the Anupshahr Division, but they were not carried to completion, because the officer making them was transferred.

Ocular evidence of reduced loss by percolation on distributaries caused by the channels having become more water-tight, is given from an inspection of the low country in some reaches in high bank. This morning (18th December), I rode up the left Bhola Distributary; for 7 miles of its length the low lying country on both sides was formerly a swamp, and a sure find for snipe. To-day I found it absolutely dry, not a water-bird of any description to be seen.

(5) *Distribution of water.*—How is the distribution of water controlled and the share of each village and cultivator determined, more specially with reference to the more recently constructed channels?

Water is distributed to villages in proportion to the cultivable area, after deducting the area of well irrigation. Water is supplied by means of outlets in the banks of distributary channels, the diameter of the outlets being sufficient to allow the required irrigation to be easily done. Outlets are either given for a single village, or to several villages in combination. The distribution of water on a water-course is generally arranged by the villagers themselves; in some cases where cultivators cannot agree, an established roster for distribution is laid down, but this method is discouraged and is seldom resorted to. Sometimes an unfortunate oppressed cultivator cannot get water, but arrangements can generally be made to give him water without our having to take up the whole distribution on the water-course.

In recently constructed channels water has been usually given for the irrigation of about 40 per cent. of the cultivated area after deducting the area of well irrgation, 13 per cent. of this area being allowed for *kharif* irrigation and 27 per cent. for *rabi* irrigation. It is not often that this proportion of area to be irrigated can be increased; in many cases it has to be reduced from an insufficient supply of water.

(11) *Flood protection and drainage works.*—Drainage of canal-irrigated districts; total expenditure incurred; and results obtained, beneficial and otherwise. Necessity for the further construction of drainage works in canal-irrigated and other districts.

The Ganges-Hindan Doab served by the Ganges Canal is now well provided with drains, and flooding does not often occur except afer exceptionally heavy rainfall.

The total lengths of canal and drainage channels in each of the last 20 years is given below, together with the yearly expenditure incurred on drain:—

Year.	LENGTH IN MILES OF CHANNELS.		EXPENDITURE ON DRAINS.
	Canal channels.	Drainage cuts.	Rupees.
1880-81	2,999	607	34,768
1881-82	2,988	723	25,181
1882-83	3,006	867	32,485
1883-84	3,015	911	14,688
1884-85	3,015	934	7,905
1885-86	3,032	956	4,521
1886-87	3,016	957	8,140
1887-88	3,077	895	37,736
1888-89	3,058	966	16,016
1889-90	3,041	965	—5,223
1890-91	3,041	972	15,425
1891-92	3,046	1,031	92,935
1892-93	3,056	1,103	90,928
1893-94	3,067	1,211	96,577
1894-95	3,105	1,315	80,965
1895-96	3,147	1,363	71,902
1896-97	3,180	1,495	59,720
1897-98	3,169	1,587	17,673
1898-99	3,188	1,598	7,803
1899-1900	3,242	1,730	20,937

From the above it appears that 20 years ago the mileage of drainage channels bore a proportion of only 20 per cent. to that of canal channels; the proportion is now 53 per cent. The total expenditure on drains in each division of the Ganges Canal during the last 50 years has amounted to 22¾ lakhs of rupees.

	Rs.
Northern Division	3,05,246
Anupshahr „	1,37,056
Meerut „	4,57,638
Bulandshahr „	9,12,618
Aligarh „	4,61,231
TOTAL	22,73,789

The drainage of the Bulandshahr Division is as nearly perfect as it can be made; that of the Meerut Division is very nearly as good; there are more artificial arterial drains, but fewer small drainage cuts. The drainage of Aligarh is good, but flooding is more frequent on account of the enormous area of bare waste salt lands. from which water pours off very rapidly. In the Northern Division there are a large number of percolation drains by means of which considerable areas of submontane land has been brought under cultivation. The drainage of the Anupshahr Division is not a difficult problem, as that canal generally lies on as the Jumna uplands.

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1. *Q.* (*The President.*)—You have had large experience on the Upper Ganges Canal?—Not very large; I was there two years, 1886-87. I was in Rohilkhund three and a half years, then I was on the Lower Ganges Canal, the Eastern Jumna, and again on Lower Ganges Canal.

2. *Q.* You say in reply to Question 3 (ix)—"But the extension of irrigation to portions of the Saharanpur, Muzaffarnagar, Meerut, Bulandshahr and Aligarh districts, through which the Ganges Canal now runs, is not recommended, because they are rather over-irrigated, specially in low-lying tracts; it might be beneficial to restrict the irrigation somewhat in this area and to extend it to good land lying in the eastern portion of the Muttra and the western portion of the Aligarh district." Have you ever restricted it?—Not restricted irrigation. The idea is to try to restrict the amount of water used in low-lying tracts, and give facilities in high-lying tracts. The former have had greater facilities in the past, and there the people take water in excess.

3. *Q.* How are you reducing the quantity of water?—By making the outlets proportionate to the amount of irrigation to be done.

4. *Q.* And if you find two villages upon the same distributary, one high-lying tract with 25 per cent. of its area irrigated, and the other a low-lying tract with 80 per cent. of the area irrigated, you would restrict the area so much as also to restrict the area of the low-lying?—No, as a rule, the actual area irrigated is not restricted. There is greater economy in the water used, but the high-lying village would have further facilities for irrigation given it. That is to say, the outlets would be large, because there could possibly be no waste. The outlets in the low-lying village would be restricted to actual necessities.

5. *Q.* Have you ever gone further than that?—No, I came across a village in the Aligarh district where the irrigation was 129 per cent. of the area in the two *fasls* (seasons.)

6. *Q.* You have reduced the size of the outlets in that village and you will not be sorry if you get a less area?—Yes. Of course there is a little margin, and you can put it to the benefit of the village or the reverse according as the margin occurs. But the actual irrigation done would not be restricted.

7. *Q.* The other day Mr. Hand, of the Opium Departmen, told us that the people down there complained very much of the restriction of the water?—Yes, there always are complaints, because the villager likes to have an ample supply of water running constantly. That, of course, water-logs the land, ruins the crops, and does great damage. I came across an instance of that in Rohilkhund where there was a dam put across a river and the crops in the neighbourhood were very poor indeed. There was another instance in Rohilkhund on the Bagal Canal where a whole tract was practically ruined by floods from a river and the water-level was high, so this country was debarred from irrigation. The floods could not get away. But that disappeared, and now the floods spread it across the land and fertilise it.

8. *Q.* You altered the conditions of the irrigation?—Yes, it was given up for the benefit of the people.

9. *Q.* Were they satisfied?—I do not think that they were dissatisfied.

10. *Q.* You are now proposing to give an extension of irrigation in the Mat direction. What percentage of the area of villages will be irrigated in that direction?—The scheme was worked out roughly for 40 per cent. of the cultivable area of the villages after deducting the area of well irrigation. We allow about 13 per cent. for the *kharif* irrigation and about 27 for the *rabi.*

11. *Q.* Judging from the papers submitted by the irrigation officers in the Doab, the chief matter of interest now is the economy of water and the adjusting and remodelling of branches?—Yes, for many reasons; to make the water go as far as it will for there is too much water used, it sours the land and raises the water-level. The souring is especially perceptible in over-irrigated tracts.

12. *Q.* For such tracts would it not be advisable to reduce the area?—I think it would. We are practically obliged to carry out the irrigation that has been done in past years. It turns on the fact that the village is assessed at wet rates.

13 *Q.* It would not be possible for the canal officer to do it; it would be revenue; but do not you think it is a thing which may be looked upon as practical?—Yes. In the village of Jalali on the Ganges Canal in the Aligarh district it would be a great benefit.

14. *Q.* (*Mr. Roberts.*)—That has been going on for years?—Yes.

15. *Q.* Is that area soured?—I fancy it must be.

16. *Q.* (*Sir Thomas Higham.*)—You have reduced the area there?—No; we only make the people use the water with greater economy.

17. *Q.* (*The President.*)—Can you arrive at any estimate of the economies you have effected?—With an area in 1899-1900 of over 1¼ million acres on the Ganges Canal the supply in the cold weather was 2,260 cusecs. We could not possibly have done anything like that had we not remodelled our channels.

18. *Q.* Could you say of a distributary that it now irrigates as much with 75 cusecs as it used to with 100?—It is hard to give an exact reply, because in the old days the distributaries used to run with less large supplies than now, when we always run them with as large a supply as possible, so as to carry out the irrigation as rapidly and easily as possible.

19. *Q.* The evidence as to the Eastern Jumna Canal went to show that we were creating economies, but not attempting to extend the irrigation, but getting more on unirrigated parts of the same village going up to 70 or 80 per cent. without hesitation?—The result of economies has been to make irrigation much more even. Compare a particular distributary in 1877 and 1897. The distributary is 18 miles long and in the first 6 miles there was in 1877 an enormous area irrigated; from mile 6 to mile 13 a part was irrigated; from mile 13 to 18 absolutely none. In 1896-97 in the third portion there were 2,500 acres irrigated on the Anupshahr Branch; in the last year the irrigated *kharif* area was 39,000 acres in the third Sub-division, and in the first Sub-division it was 37,000 acres. It was the first time in the history of the canal when the *kharif* irrigation of the 3rd Sub-division beat that of the 1st, and that was due to alteration of the distributaries to enable the water to get down to the 3rd Sub-division of the branch. What has been done on the Sub-divisions of the Anupshahr Branch has been done on the three reaches of almost every distributary. The 1st, which used to irrigate enormously, irrigates more than it used to do with less water; the 3rd reach gets more water and it has doubled the area irrigated.

20. *Q.* Does not that show that you have not gone far enough? You do not want to increase the irrigation of the 1st Division. So long as that has gone on increasing, you are giving it too much water still; are you not? Granted that it is done with less water, do you want to increase the area irrigated in your upper divisions?—Not in such villages, but they may carry the water 5 miles from the canal to other places. We are reducing the water-supply to each village in the 1st Sub-division as much as possible.

21. *Q.* (*Mr. Roberts.*)—In the villages originally served is the irrigation more intense than it was before?—Not the average.

22. *Q.* (*The President.*)—Water is so priceless that I should be jealous of giving more where there was enough already?—Yes, that is thoroughly well understood.

23. *Q.* Is it within the bounds of experiment to puddle distributaries?—There was such an experiment started, but the Sub-divisional Officer making it was transferred. The loss from percolation over the whole Ganges Canal, I find, varies from 13·1 to 16·2 per cent. of the amount of water entering the canal. Sir Thomas Higham worked it out at 20 per cent. in the Punjab. That was on the main canal. On the distributaries I found 6·8 to 8·2 per cent. to represent the loss. Sir Thomas Higham got at about 6 per cent. Between the outlet and the head the loss comes out at from 19 to 24 per cent. Sir Thomas made it about 20 per cent. Ours is slightly less.

24. *Q.* We had evidence from Mr. Nelson who had been on the Mat Branch that it cost Rs. 5,000 a mile for puddling distributaries?—Yesterday morning I came up a distributary, which was most exquisitely puddled. The sides of the bed were covered with silt by a natural process.

25. *Q* On page 139 of your paper in answer to Question 7 (ii) you give figures showing the increase of indigo. I suppose indigo is quite off now?—Yes. There is a large indigo tract belonging to Mr. Michel. The manager told me yesterday that they have given up indigo altogether. He proposes to grow sugar and start a sugar factory.

26. *Q.* Is cotton starting in its place?—Yes, very largely; it is a decidedly increasing area.

27. *Q.* On page 140 in answer to Question 11 you say—"Some deterioration of soil can also be traced in the Bulandshahr District from too profuse irrigation." Is Bulandshahr the highest irrigated district now? Meerut used to be?—Yes

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Bulandshahr went ahead tremendously in 1899-1900. It is the most advanced of all the Divisions on the Ganges Canal; the system of distributaries is the best managed and the best drained. There has been more money spent there.

28. *Q.* Is there a danger of over-draining?—Not *per se*, but a danger of doing small damage to individual cultivators, such as men with a little bit of *jhil* land where they grow rice. It is hard on them when the *jhil* is drained. In the Bowar Branch of Mainpuri the people complained very much about it, but you can put a small regulator in the drain and allow the villagers to bank it up when they wish to irrigate their rice.

29. *Q.* In the beginning of your note you alluded to the shortness of establishment, which has been brought before our notice?—In the six Divisions I have only eight Assistant Engineers, of whom four are in the Public Works Department with a temporary English Engineer, and three Native Engineers; seven subordinates and one Deputy Magistrate in charge of a sub-division and only one spare subordinate.

30. *Q.* In the earlier days we had two or three Assistant Engineers in each Division, but the promotion was very slow?—I was 14 years Assistant Engineer.

31. *Q.* How are you going to keep promotion flowing and yet have sufficient staff? You want good men?—The introduction of subordinates into the sub-division has not yet been the ruin of our department, but it will bring it down to the lowest ebb. I have known men in charge of a sub-division who were the most unqualified for their charges. A man to be constantly in connection with the landlords and cultivators, must have great tact and have administrative ability, be a gentleman in other words. It is absolutely no saving to Government to have inefficient subordinates in charge of sub-divisions, because the Sub-divisional Officer can pay his way ten times over by doing half an hour's work more a day than before, by improving irrigation, and the general better management of his sub-division. A subordinate receives Rs. 200 a month and an Assistant Engineer Rs. 500, and the loss on the subordinate is more like Rs. 3,500 loss than Rs. 3,500 gain.

32. *Q.* But how to keep the promotion going?—I think Executive Engineers are very much over-worked; they have enormous charges. The Agra Canal is an enormous charge; the Bulandshahr Division is one with about 1,200 miles of channel. We ought to have more sub-divisions and divisions, and in the long run it would be to the benefit of Government. The establishment charges would not be increased, because of the greater economy of water and the better work done. One cusec is about Rs. 783, and the value of the crops raised is nearly Rs. 8,000. A man who can save 1 cubic foot of water per mensem more than pays for his pay. You want more and better men, more keen on their work. The work on a canal is one of the most trying you can possibly have; Canal Engineers are out in the hot weather, the rains, and all through the cold weather; irrigation is precarious and the most valuable crops depend upon it. When possible the canal is closed, and heavy repairs have to be done. Floods and breaches and worse take place, necessitating the presence of the Executive Engineer and the Sub-divisional Officers. In the cold weather there is always inspection going on, and it is the best time for work, but the 24 hours are very short ones. A married man has to keep up practically three establishments—one for a portion of his family at the head-quarters of the district, another for himself, and a third for his children in the hills, it means a very large outlay, and he must have constant means of locomotion. A Canal Engineer is the only man who has to keep up carriage for his camp all the year round.

33. *Q.* I suppose his travelling allowance covers that?—Mine does not. Life for a married man is very trying, and most men try to get away from the department. Men are always leaving us for the Roads and Buildings Branch.

34. *Q.* (*Sir Thomas Higham.*)—With regard to that tract in Aligarh?—It lies to the east of the Karon Nadi, where there is a great deal of *oosar*, not a good place for irrigation because the water-level was very close to the surface; a *big* drain has been made from Aligarh which goes right through, and the Karon Nadi is very much improved. We propose to extend the Mat Branch into Aligarh.

35. *Q.* It does not go into Aligarh?—A small portion does.

36. *Q.* Mr. Alexander was speaking of a part of Aligarh which required irrigation very much?—Yes, a portion of Pargana Hathras. But we have not the water to spare and the country is very bad; the *oosar* is extensive, and there is a danger that the introduction of water will do more harm than good.

37. *Q.* I gather you have quadrupled your irrigation on the Anupshahr Branch since 1877. How?—By better distribution and remodelling channels.

38. *Q.* But if you let the water into a distributary, it is difficult to control it. You can always control it at the head of a distributary?—The Anupshahr Branch has been widened and enlarged to enable the supply to get down.

39. *Q.* And now about the supply entering the head of the branch?—That has been slightly increased. About 1,200 feet was the volume to run our channels simultaneously. Now we want 1,412. An experiment has been made to run the Anupshahr Branch alternately, every fortnight, with two other branches. We save 84 cusecs permanently by that method from percolation.

40. *Q.* You would lose a lot by refilling the channel; you have to wet your perimeter. If you close the channel a fortnight or ten days and fill it up again you lose a lot?—I have no figures to show that.

41. *Q.* You only run the distributaries at intervals when you have not the water to run them regularly?—We always do.

42. *Q.* All through the *kharif?*—Yes; during the *paleo* season for first sowings we run the distributaries for five weeks, and close them for a week on end, then two weeks on end.

43. *Q.* You reduce the time as the supply is reduced; as long as you think the supply equal to the demand you will go on running?—No; we never run them constantly at other times. It is only in one period of the *kharif* and *rabi* that we run for five weeks consecutively.

44. *Q.* Because later on the demand is less?—Yes; two weeks in three are sufficient. We find it does the channel good to give it a closure and prevents the country getting water-logged, in times of tight supply, as at present we are running alternately. There are exceptions to this rule. In the Northern Division there is an exception owing to the fact that there are three *paleo* seasons—one sugar in March and April, another about the end of May for the early rice *paleo* season, and they have to run five weeks a second time there. Then at the beginning of the *rabi* we have to run five weeks also.

45. *Q.* In these low-lying lands, where the water has been very much wasted, you have restricted the supply by reducing the quantity of water?—To the same average as the rest of the distributary; not reduced it specially; in the case of this one particular village there are 50 acres per cubic feet roughly in the *kharif* and about 120 in the *rabi*.

46. *Q.* That is supposed to be running five weeks on end?—If the channel is run continually through the whole period, you allow 50 acres a cusec?—We do not run the channels permanently. We close them, though we have the water.

47. *Q.* But it surely makes a difference what duty you allow whether the channel runs constantly or half time?—Yes. That is the duty we find we can work the distributary on. Where there is both *rabi* and sugarcane simultaneously about 120 to 130 feet would be the necessary basis.

48. *Q.* What difference do you make in outlets supplying low and high-lying lands?—The outlets on low-lying lands are as small as possible. For high lands we give them the benefit of the doubt.

49. *Q.* You assume the same duty in both cases. I understand you have contracted the supply very much in low-lying lands. I want that expressed in the terms of the duty you allow?—Portions of the channels run through high and portions through low lands and you get both lift and flow from every distributary.

50. *Q.* Then practically the only difference you make is, if there is a great amount of low-lying land, you do not give them the benefit of the doubt. There is no regular rule?—No. For the lift irrigation you can give much more than for the flow, because there is no chance of waste. You can give it unnecessarily large.

51. *Q.* These duties, we are speaking of, are the duties on which you calculate the size of the outlets?—The outlets are generally of two sizes, 4½ inches in diameter and 6 inches, called *colabas*. I believe there are smaller ones used, but not on this canal. If it is 30 acres to be irrigated with an outlet for lift irrigation, we give a 6-inch; for a flow one we give a 4½-inch, assuming that 50 acres is the duty that a cubic foot can irrigate.

52. *Q.* For the 6-inch *colaba* what is the area?—We would allow 50 acres of irrigation for the *kharif*; that is practically a cubic foot of water.

53. *Q.* I am asking about the outlets for low lands?—The distance, which you have to carry the water, is another point.

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All these things are thought of in deciding whether to give a 6-inch or a 4½-inch outlet in any particular place, the duties vary so excessively in every individual place.

54. *Q.* With these new distributaries you say you are going to give water for 40 per cent. of the area, after deducting the well irrigation. Are any lands debarred from taking water?—We do not give outlets in the neighbourhood of water-courses to reach well irrigation.

55. *Q.* Supposing people make a drain and take water through a water-course, and can take it into the well lands?—We tell them not to do it and threaten to reduce the diameter of the outlet.

56. *Q.* You have only two diameters?—We can reduce from 6 inches to 4½.

57. *Q.* Not a punitive rate?—I cannot recall that we have debarred well irrigation, but we can debar it by notice and charge double rates as a punitive measure.

58. *Q.* Is that power ever exercised?—I have never exercised it.

59. *Q.* Is there any place on your canal where well irrigation is allowed under that rule? What are you going to do with the wells in future on the Mat?—We are going to allow the wells to irrigate, but the wells have fallen in so largely, and the water-level is at such a tremendous depth, that they cannot be worked in many places.

60. *Q.* You will have to give them canal water?—Yes.

61. *Q.* Is it fair to deduct your well irrigation before you make your allowance of 40 per cent.?—Yes, because wells can always be used to some extent—to a very small extent. I came by the tract of country in the Muttra district to be served by the Mat Canal extension, and I saw a man waiting half an hour or three-quarters before there was enough water in the well to lift another lot of water. Of course that is irrigation under tremendous difficulties and that would not affect the question.

62. *Q.* (*The President.*)—Is the Eastern Ganges or the Ramganga any good for Rohilkhund?—There is an objection as to the spring level. We are in Rohilkhund turning the earthen *bunds* into a masonry dams and making the water go further, and we have done a good deal in Bijnor in the last few years.

TWENTY-NINTH DAY.

Meerut, 29th December 1902.

WITNESS NO. 57.—MR. H. MARSH, Chief Engineer, Irrigation Branch, United Provinces of Agra and Oudh.

(*Replies to printed questions.*)

Mr. H. Marsh.

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A.—GENERAL.

1. Tract watered by Agra Canal. It has been in my Circle since 1898. I held charge of it as Executive Engineer in 1898. I served as an Assistant Engineer on it in 1874—77.

2. Average rainfall as noted below:—

	Rainfall in inches.
January	0·42
February	0·25
March	0·24
April	0·06
May	0·43
June	1·98
July	9·82
August	7·25
September	4·19
October	0·28
November	0·01
December	0·20

3. (1) No.

(2) No.

(3) No.

(4) Some land is too much impregnated with *usar* salts. Some is too sandy, too high or too irregular.

(5) No; supply is certain, and comes partly from the Jumna, partly from the Hindan, and partly from Ganges Canal surplus.

(6) No.

(7) No.

(8) No.

(9) (*a*) One reason which militated against extension of irrigation was the unmanageable nature of the charge. Instead of being held by two Divisional Officers, and four Sub-Divisional Officers, it was in the sole charge of one Divisional Officer and three Sub-Divisional Officers. I reported fully on this matter a year ago, and I hope something is going to be done. Until it is done, the charge of each man is too much, and the distributaries suffer in their maintenance.

(9) (*b*) There was no telegraphic communication along the line. I wrote strongly a year ago about this, and I believe the case is in the hands of the Telegraph Department now.

(9) (*c*) Want of a railway through the heart of the country. The earthwork of the Muttra-Delhi Railway was begun as a famine work, but its further progress has been stopped, in consequence of its backward position in the railway programme.

(9) (*d*) Want of arterial drains in the Muttra and Gurgaon districts. I wrote strongly about this a year ago, and something has been done. I am now finishing one scheme in my own office, but there is enough work for a special officer.

The country in question has no defined drainage lines, but holds many large shallow hollows which are landlocked. *Rabi* sowings are therefore often delayed, and early *kharif* crops are often drowned out. Moreover, the want of arterial cuts gives the canal officers no escapes, and he has therefore to run his channels in a timorous manner, sometimes losing irrigation and sometimes spoiling crops, by breaches, and excessive supply.

(9) (*e*) The distributaries were far too small for their work, and they had too many outlets. The result was that when water was in urgent request it could not be got to travel to the lower reaches of the channels. This state of stringency then gave an erroneous idea to officers that the supply was not sufficient, and further extensions were stopped. During the last two years great progress has been made in the opening out of the channels and the weeding of superfluous outlets. The result is that irrigation is quickly done, and the supply that used to seem short is plentiful and can stand further stretching. Consequently the Nandgaon Distributary has just been sanctioned, and the Executive Engineer has minor projects for extensions in hand. But he is overworked and much progress will not take place until the Division is broken into two.

B.—CANALS OF CONTINUOUS FLOW.

7 (1) More than double I should think.

(2) Could not say exactly. It depends on the cultivators. Good cultivators will double the produce.

(3) (*a*) The rain might be ample, but might not come at the right time. If it did come at the right time, the unirrigated *rabi* would, in good soil, be perhaps better than the irrigated, which might suffer from rust. But indigo, sugar, and vegetables could not get on without irrigation.

(3) (*b*) The yield in a well managed irrigated tract would be double and treble that of the unirrigated. In fact in many cases there would be no yield at all on the unirrigated tracts, especially where the soil is stiff and hard. On the other hand, in sandy soil, or black soil, very little rain pulls crops through.

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(3) (*c*) In a year of drought the unirrigated crops do not exist. The irrigated crops will suffer also on account of the parching winds. Water cannot be served out quick enough to prevent an eight-anna or four-anna loss in the produce.

B.—11. Injury has occurred from too constant running of distributaries. This was necessitated from their want of capacity to do the work quickly. When the extensions now in hand are finished; when the existing channels are remodelled as already explained; when the divisional staff is increased; when the railway and telegraph facilities are provided; and, lastly, when the drainage and escape programme is carried out, it will be possible to economize water to a nicety, prevent profuse irrigation, and utterly debar waterlogging. I think the work that has been going on during the last two years has done a good deal to mend water-logging. But if another wet year comes before our drainage system is complete a large part of the Agra Canal tract must suffer, as it is almost devoid of natural outfall. I have designed and carried out a great many drainage works in the Etawah Division, Lower Ganges Canal; Bulandshahr Division, Ganges Canal; Meerut Division, Ganges Canal; Northern Division, Ganges Canal; Eastern Jumna Canal, and have great faith in their efficiency. But they want careful watching. The cuts should not be made too large at first, or they may produce spills lower down, and thus relieve one tract at the expense of the other.

Well designed drainage works, if properly maintained, are of immense benefit, and, in fact, a necessity to the irrigated plains.

Note, dated 21st October 1902, on extension of irrigation works on the Upper Ganges Canal.

1. A statement of proposed minor extensions on the Upper Ganges Canal is attached. (I can show maps exhibiting the scope if required.)

2. They were collected from the Executive Engineers. Delay in carrying them out has occurred more from want of establishment than from want of funds.

3. We are in great need of well paid Surveyors who would take a pride in their work. At present our surveys are often carried out by Sub-Overseers on pay of Rs. 30 to Rs. 50.

These men hate the task, and are always endeavouring to be employed on maintenance, or on construction, where chances of promotion and of illegal gratifications are more common.

I think a cadre of Surveyors should be sanctioned, with pay rising from Rs. 75 to Rs. 300, and one man should be allowed for each division.

4. Projects for extensions would then come in much quicker, as Executive Engineers would feel less alarm about the correctness of levels.

Statement showing the possible extensions of irrigation from existing canals in the First Circle into Minor Doabs which are as yet unprotected by them.

NORTHERN DIVISION, GANGES CANAL.

Number.	Name of project.	Approximate length of channel.		Abstract of remarks by Executive Engineer.	Remarks by Chief Engineer.
		M.	F.		
1	Majhaul Minor Extension	2	0	Under consideration	Project is awaited.
2	Salanni Minor	2	5½	Ditto	Ditto.
3	Manki Minor	3	0	Ditto	Ditto.
4	Asadpur Minor	2	5	Ditto	Ditto.
5	Sanpla Minor Extension	2	6	Ditto	Ditto.
6	Ghalauli Minor	3	6	Estimate under preparation	Ditto.
7	Kulsat Minor	1	4½	Estimate ready	Ditto.
8	Ambahta Minor	2	1½	Ditto	Ditto.
9	Paoti Minor Extension	2	1	Under consideration	Ditto.
10	Badhai Minor	1	5	Ditto	Ditto.
11	Dadheru Minor	2	4½	Ditto	Ditto.
12	Kazi Khera Minor	2	7¼	Ditto	Ditto.
13	Ladeva Minor	1	5	Ditto	Ditto.
14	Sohanjni Minor	1	5	Ditto	Ditto.
15	Kakra Minor	2	2	Ditto	Ditto.
16	Kutba Minor	2	0	Ditto	Ditto.
17	Goela Minor	1	0	Ditto	Ditto.
18	Shahdabbar Minor	1	6	Ditto	Ditto.
19	Tanda Minor	1	1	Ditto	Ditto.
20	Datiana Minor	1	3½	Ditto	Ditto.
21	Patoli Minor	1	6½	Ditto	Ditto.

ANUPSHAHR BRANCH.

Number.	Name of project.	M.	F.	Abstract of remarks by Executive Engineer.	Remarks by Chief Engineer.
22	Anti Minor Extension	12	0	* This doab is unsuited for canal irrigation owing to sand hills, large depressions and drainage, but zamindars have petitioned for the extension. It does not appear to be judicious to extend the Anti Minor, as this country is protected by *pakka* wells.	This may be dropped.
23	Datiana Minor Extension	4	7	The Shikarpur Branch was projected to relieve this country, but found undesirable. If the Datiana Minor be extended 4 or 5 miles along the line of the Shikarpur Branch, the village at the head of the doab (between the Nim and Kali Nadis) would get water; at present they are badly in need of artificial irrigation.	Project is awaited.

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* Between Choiya and Kali Nadi.

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Statement showing the possible extensions of irrigation from existing canals in the First Circle into Minor Doabs which are as yet unprotected by them—(continued.)

Number.	Name of project.	Approximate length of channel.	Abstract of remarks by Executive Engineer.	Remarks by Chief Engineer.
		MEERUT DIVISION.		
24	Pimora Distributary Extension .	2 5	Extension wanted for new irrigation in Usang and other villages.	Project is awaited.
25	Bhulwa Minor Extension . .	2 2½	Extension wanted for new irrigation in Tulsipur, Kheri, Nagla, Rod and Bazidpur villages.	Ditto.
26	Bahpur Minor (from mile 1, Daurala Distributary).	5 1	A new minor to extend new irrigation in dry doab between Nagan Nadi and Chand Samand Drain.	Ditto.
27	Jitpur Minor Extension . .	3 4	Extension wanted for Lohra and Ikhtiarpur villages.	Ditto.
28	Mataur Minor Extension .	3 0	Extension wanted for Samauli, Mohammadpur and Kailauti villages.	Ditto.
29	Meerut Minor Extension . .	3 5½	Extension wanted to take up the Meerut Government Farm and do new irrigation in Kazipur and other villages.	Ditto.
30	Meerut Distributary with Branch	20 0	There is a large tract of land between Karauli Drain and Kali Nadi untouched by canal irrigation, into which Meerut Rajbaha can be extended.	A preliminary report is required.
31	Partabpur Minor Extension . .	3 1	This minor can be extended into Kashi and Attehra villages.	Project is awaited.
		BULANDSHAHR DIVISION.		
32	Sahenda Minor	3 7½	...	Project prepared, but was returned for alteration.
33	Utsara and Senta Minor . .	4 5	...	Ditto.
34	Bhawa Minor with watercourse .	3 3	...	Ditto.
35	Saneta Minor	2 7¾	...	Ditto.
36	Pachokra Minor	1 7	Will irrigate about 500 acres of Rustampur, Pachokra, Niloni and Ratanpura. No roads or drainage intercepted.	Project is awaited.
37	Khairabad Minor . . .	4 7¼	This is a very good line and will be about 4 miles long and tail into the Siwaya Escape in mile 3 and will irrigate about 500 acres.	Ditto.
38	Manphas Minor with Branch .	7 7	A very good irrigation tract .	Project is about to be sanctioned.
39	Umri Minor	6 3½	This will take out of Barauda Distributary near mile-stone 34 and tail into the Karor. Looks a likely country for irrigation.	Project is awaited.
40	Manpur Minor	2 7	This is a small minor about 3 miles long and will probably irrigate about 300 acres.	Ditto.
41	Garhi Minor Extension . .	6 0	Levels have been taken, but requires to be gone over again, as there is a good deal of well irrigation.	Ditto.
		ALIGARH DIVISION.		
42	Hathras Branch	55 0	Starting from main canal mile 148, irrigating between the Aligarh Drainage Cut and Karon Nadi, and running down to Hathras. People are crying out for it.	I am doubtful about this, as I fear there is much *usar*. A preliminary report, with soil map and well statistics, will be called for.
43	Mendu Branch	32 0	An extension of the Koel Distributary from mile 28, irrigating between Jeffrey's Cut and Aligarh Drain and running down to Mendu.	Ditto
44	Maheshpur Minor . . .	7 0	Taking out of Koel Distributary, mile 21½, to irrigate between Lehtoi Drain and Jeffrey's Cut.	Ditto.
45	Chauk Minor	2 4	Taking out on right bank of Harduaganj Minor.	Project is awaited.
46	Garhi Minor	8 0	Taking out on right bank of Harduaganj Distributary, mile 31½.	Ditto.
47	Begumpur Minor . . .	4 0	From tail of Harduaganj Minor, mile 39½, left bank.	Ditto.
48	Zainpur Minor	2 4	Taking out on right bank, Lodipur Distributary, mile 7.	Ditto.
49	Rejua Minor	3 0	Taking out on right bank, Sitapur Distributary, mile 6.	Ditto.

Mr. H. Marsh.

20th Dec. 02.

Office Memorandum No. C.-1175, dated Naini Tal, the 23rd October 1902.

From—C. H. Hall, Esq., Under Secretary to Government, United Provinces of Agra and Oudh, Public Works Department, Irrigation Branch,

To—The Chief Secretary to Government, United Provinces of Agra and Oudh, Scarcity Department.

In continuation of this office No. C. 1172-I., dated 21st October 1902, Under Secretary is directed to forward a note, No. C 1174-I., dated 23rd idem, on the expansion of irrigation from existing works as required by paragraph 3 of the Memorandum of points to be considered by the Irrigation Commission.

Note, dated 23rd October 1902, on the expansion of irrigation from existing works.

About 20 years ago attempts to improve the economy of water was actively carried out by Captain Hall in Cawnpore Division.

He amalgamated watercourses and did a lot of good. His fault, however, was that he gave too small apertures in the outlets, and ran the channels constantly.

2. As Executive Engineer in Etawah Division I attempted a similar task in 1887 and 1888, and was rewarded with great success. Each distributary and its commanded area was mapped out on large cloth sheets,* which delineated all the watercourse ramifications, lift, flow, and well irrigation, as well as drainage and waste soil. Skilled Deputy Magistrates prepared statements of the annual irrigation effected by each watercourse, and submitted statements of superfluous outlets. These were then examined on the ground by myself and my Assistants, and final orders issued for the removal of only those that were redundant.

* Typical maps will be laid before Commission. H. M.

In doing this the support of the District Magistrates was invited, and of course the levels of the country were also considered.

3. The alterations were effected as far as possible in the dead time of the irrigating seasons, so as to inconvenience the cultivators as little as possible.

4. Needless to say many petitions were submitted, but they were all carefully looked into and trouble mitigated. The result of this weeding was that—

(*a*) the number of outlets was reduced from 7,500 to 4,500, and an immensity of waste prevented;

(*b*) "tatils" were abolished and power of the petty officials in levying blackmail was minimized.

(*c*) The Canal Officer and his staff were spared the very serious trouble of passing supply to the tails. This gave them time to prepare projects for drains, minors, etc., and for improving the sections of distributaries.

5. The result of these salutary measures caused much satisfaction to Colonel Forbes, Chief Engineer, and Mr. Beresford, Superintending Engineer, and Colonel Corbett, R.E. The people rejoiced openly over the ease with which they obtain their irrigation and their freedom from oppression. Orders were issued to carry out similar measures elsewhere, but for some reason not much progress was made.

6. The benefit to Government was great, as it was possible to equalize the distribution of water and give as much supply at the tails of the channels as at the heads.

The economy of volume allowed for extensions elsewhere. One test of the benefit was that the record *rabi* area in Etawah Division rose from 170,000 acres to 230,000† acres, although the supply was diminished.

† This is the true criterion of the efficiency of a distributary-system. Average areas are no guide, as in such years water is superabundant. H. M.

7. In 1892 I returned from furlough and commenced similar operations in Bulandshahr.

In one year 1,700 outlets were cut out of a total of 5,700 and *tatils* abolished.

In three years the mileage of Government distributaries was increased from 611 to 720.

The mileage of drains rose from 236 to about 500.

The salutary result of these measures was that the record *rabi* area rose from 134,000 to 180,000 acres and the *kharif* from 88,000 to 106,000.

Tatils used to be so strict in this division that murders were frequent, and petty canal officials amassed large sums by illegal methods.

All these evils disappeared, and, combined with the sanitary effects, caused a striking increase in the population.

Comparing the census of 1891 with 1901 we find the figures are—

Zila Bulandshahr	1891	949,914
" "	1901	1,138,101
	Increase	188,187 or 17 per cent.

8 Independent of reducing outlets, the beds of the channels had to be regarded and enlarged in a scientific manner from head to tail. This latter work was of course very laborious.

9. In 1896 I was transferred to Roorkee Division, and there again instituted similar procedure. The work only took a year. Here again the drought *kharif* area rose from 50,000 acres to 62,000‡ acres, and the *rabi* from 62,000 acres to 75,000‡ acres.

‡ That is to say, the record area was raised 24 per cent. H. M.

10. It may here be pointed out that the great secret for increasing areas is not only to prevent waste, but to devise channels of sufficient carrying power. By this means a high volume in the river can be utilized in times of good demand, and the irrigation quickly effected.

Thus before Bulandshahr remodelled its distributaries could only utilize about 1,000 cusecs, as compared with 1,400 cusecs which it can take in now. Therefore in the critical *paleo* season some 1,200 acres can be watered in 24 hours over and above what used to be possible. If the period of excess volume lasted 20 days the result is very important.

11. Since 1898 I have held charge of the 3rd Circle and have carried out similar improvements on the Eastern Jumna, Agra, Betwa and Rohilkhand Canals. The accompanying note on the drought of 1901-1902 shows that good results have followed.

On the Betwa, I regret to say, that my hands were greatly tied in the project for improving the Kathaund, or it would certainly have done much better.

12. For some years past I have paid special attention to the subject of rendering the channel of distributaries watertight. Puddling is no doubt a complete cure, as may be seen in the tanks of the Agra Park. Before puddling the water rapidly disappeared, but there is now no trace of loss.

Still I do not recommend it for distributary channels except in treacherous soils.

I believe the secret is to grade the beds with minimum slopes, so that the finer particles of silt will line the perimeter with impermeable deposits. It was in 1898 that I discovered that the smallest possible gradient is the best to secure this object. I found a distributary in the Meerut Division which had been regraded by then Colonel Ross in 1882. It had a perfect perimeter lined symmetrically into a cupshape form.

I looked up his notes, and found that he had only been able to give a slope of ·56 per mile instead of his favourite 1·04 per mile. He lamented the fact, but the result was that it gave me the key for an important reform.

13. Many of my predecessors had gone on the lines of following the slope of the country, almost as if they were laying out the formation line of a railway. Their aim was to avoid as many falls as they could, and thus save a bagatelle in the capital cost.

Now my belief is that the more falls we have the better, and the slower the slope the better. In this way water can be carried up to the exact point at which an outlet is wanted, and then dropped again into digging until the next point for an outlet is required.

Mr. H. Marsh.

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The broken gradient enables an observing officer to usefully raise or lower a few furlongs lying between two falls without affecting the rest of the channel. In old days this was impossible as the distributaries ran for miles without a drop.

14. In the Dun, where the slope is some 30 feet a mile, we find that a series of drops give us a far more watertight channel than the old masonry conduits.

Similar operations have been carried out in zamindari channels issuing from the Bahadurabad Mill channel.

I attach a special note on this enterprise.* The burden of it is that for an outlay of Rs. 21,000 we have reduced the required discharge from 42 cusecs to 19 cusecs, and have increased the area.

This is a very striking fact and means a capital return of 19 x 20,000=380,000.

The value of the sedimentary system of puddling a channel is that it keeps itself in order. The weak point of hand puddling is that it is financially prohibitive and gets worn out in time.

Copy of Note by M. **Nethersole**, Esq., *Executive Engineer, Northern Division, Ganges Canal, on the Minors in the 1st Sub-division.*

Reference. Chief Engineer's Inspection Note No. C 139-I. of 23rd April 1902.

Object of the scheme.

The general report on the estimate for minors indicates that they were constructed entirely in order to economise consumption, and that it was not intended to increase the areas irrigated.

The aggregate consumption of the village channels, which the minors replaced, was estimated at 42·5 cusecs on the basis of observed discharges, and the *kharif* area at 1,218 acres.

The minors are allotted an aggregate discharge of 34·25 cusecs for the same area. No data are available to show the period that the old channels ran, but it is presumed that, as village watercourses, the running was at the discretion of the owners, and that they were run constantly whenever there was demand.

The object of the scheme fully realized.

The minors are Government channels and are now restricted to ⅔ running, so that the net saving in water is probably fully 40 per cent. of the volume formerly used and possibly rather more.

Concurrent increase in irrigation.

The following are the areas in acres irrigated each *fasl* in the tract concerned from five years preceding the construction of the minors up to date.

Year.	1302 = 1894-95.	1303 = 1895-96.	1304 = 1896-97.	1305 = 1897-98.	1306 = 1898-99.		1307 = 1899-1900.	1308 = 1900-1901.	1309 = 1901-02.
Kharif . . .	359	645	1,069	1,006	1,068	Minors constructed	442	1,220	1,014
Rabi . . .	25	546	1,085	964	62		3,031	363	1,196
Total .	384	1,191	2,154	1,970	1,130		3,473	1,583	2,210

Averages preceding and subsequent to construction of the Minor.

	Kharif.	Rabi.	Total.
For the five years preceding construction.	829	536	1,365
For the three years subsequent to construction.	892	1,550	2,442

Whole increase not fairly attributed to minors.

In considering these figures it is necessary to remember that the irrigation in this tract close to hills is even more liable to fluctuations dependent on seasons than is the case lower down the doab.

The year 1899-1900, the *rabi* area of which materially swells the total average since the minors were constructed, was a record year everywhere, and it is therefore scarcely fair to credit the whole of the increase to the construction of the minors.

Nevertheless the figures can only be regarded as the very satisfactory as indicating increase of irrigation concurrent with economy in consumption, which, as I have already pointed out, was the primary object of the scheme.

NORTHERN DIVISION, GANGES CANAL.

Statement showing area irrigated in acres and revenue derived from mill streams minor in First Sub-division.

Year.		Preceding construction of minors.							Subsequent to construction of minors.					Remarks.
		1894-95 = 1302 fasli.	1895-96 = 1303 fasli.	1896-97 = 1304 fasli.	1897-98 = 1305 fasli.	1898-99 = 1306 fasli.	Total.	Average.	1899-1900 = 1307 fasli.	1900-1901 = 1308 fasli.	1901-02 = 1309 fasli.	Total.	Average.	
Kharif	Area . . .	359	645	1,069	1,006	1,068	4,147	829	442	1,125	1,014	2,581	860	
	Revenue . .	2,300	4,129	6,230	6,659	6,957	26,265	5,253	2,502	7,857	6,468	16,827	5,609	
Rabi .	Area . . .	25	546	1,085	964	62	2,682	536	2,894	363	1,196	4,453	1,484	
	Revenue . .	100	1,703	3,348	2,997	204	8,352	1,670	9,130	1,110	3,837	14,077	4,692	
Total	Area . . .	384	1,191	2,154	1,970	1,130	6,829	1,365	3,336	1,488	2,210	7,034	2,344	
	Revenue . .	2,400	5,832	9,568	9,656	7,161	34,617	6,923	11,632	8,967	10,305	30,904	10,301	

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* Not printed.

Mr. H. Marsh.

20th Dec. 02.

Note on the working of the minors in the 1st Sub-division, Northern Division, Ganges Canal, constructed during the year 1898-99.

1. I remember these water-courses perfectly. They ran whenever there was demand and flooded the country freely.

2. Lieutenant Beach, Royal Engineers, took the discharges and found they amounted to 42 cusecs.

They are now restricted to two-thirds of the days in which there is demand, and thus the total required discharge is only 34 cusecs. Consequently the economy of water is represented by the difference between 42 cusecs and two-thirds of 34 cusecs, *i.e.*, 19 cusecs. At the same time I think the minors should only run half time and then the saving would be 25 cusecs. Taking the former figure the capital value of the water economized would be :—

19 × 20,000 = 380,000.

3. This is a very remarkable result, springing from an outlay of Rs. 21,477, and is independent of the facts that the country is much improved, and that the irrigation has increased.

4. For some reason Mr. Nethersole has compared the average of the returns for five years preceding the remodelling with those of three years succeeding it. If we omit the returns for 1894-95 and 1895-96 the case will be on a fairer basis, thus :—

Area.	Acres.	Area.	Acres.
1896-97	=2,154	1899-00	=3,473
1897-98	=1,970	1900-01	=1,583
1898-99	=1,130	1901-02	=2,210
Total .	5,254		7,266

Increase in three years =2,012 acres.

again—

Revenue.	Rs.	Revenue.	Rs.
1896-97	=9,568	1899-00	=11,632
1897-98	=9,656	1900-01	=8,967
1898-99	=7,161	1901-02	=10,305
Total .	26,385		30,904

Increase in three years = Rs. 4,519.

Hence, if we only consider the direct annual irrigation revenue the return amounts to Rs. $\frac{4,519}{3}$ = Rs. 1,506, or about 7 per cent. on a capital outlay of Rs. 21,477.

5. I think these facts might be printed, as they will bring home to Irrigation Officers the immense amount of good work that can be done in remodelling long and wasteful zamindari watercourses.

Office Memorandum No. C.-1214-I., dated Camp, the $\frac{6}{11}$th November 1902.

From—C. E. Hall, Esq., Under-Secy. to Govt., United Provinces of Agra and Oudh, P. W. Dept., Irrigation Branch,

To—The Chief Secy. to Govt., United Provinces of Agra and Oudh, Scarcity Dept.

In continuation of this Office Memorandum No. C.-1212-I., dated 5th November 1902, Under-Secretary is directed to forward the notes by Mr. H. Marsh, C.I.E., Chief Engineer Irrigation Branch, on paragraphs I and II, and 11 and 12, respectively, of the Memorandum of points to be considered by the Irrigation Commission.

Note on paragraph 11 of Memo. of Points to be considered by the Irrigation Commission.

The results obtained from the different drainage works have been recorded year by year in the revenue reports; a special section was regularly provided for this.

2. The total capital expenditure up to 31st March 1902 amounts to Rs. 29,23,303, and the following financial statement indicates how much attention has been paid to this matter :—

Year.	Extensions and improvements.	Maintenance and repairs.	Expenditure, neither capital nor revenue.
	Rs.	Rs.	Rs.
1897-98 . . .	25,888	61,119	39,017
1898-99 . . .	22,275	75,983	30,764
1899-1900 . . .	15,146	71,405	41,196
1900-1901 . . .	16,288	67,749	59,265
1901-1902 . . .	21,418	74,107	91,162
Previous expenditure .	2,15,686	72,23,112	10,16,211
Total up to date .	3,16,701	75,73,475	12,77,615

3. The extension of the drainage system is shown in the following statement :—

Year.	Length in miles of drainage works.
1882-83	1,403
1883-84	1,476
1884-85	1,552
1885-86	1,548
1886-87	1,572
1887-88	1,580
1888-89	1,671
1889-90	1,712
1890-91	1,820
1891-92	2,047
1892-93	2,220
1893-94	2,398
1894-95	2,518
1895-96	2,638
1896-97	2,932
1897-98	3,072
1898-99	3,125
1899-1900	3,166
1900-1901	3,311
1901-1902	3,327

The memorandum already forwarded by Chief Engineer and Mr. Nethersole, Executive Engineer, gives some particular cases in which marked benefits have been derived from drainage works.

Note on paragraph 12 of Memo. of Points to be considered by the Irrigation Commission.

There were no famine works required within easy range of the canal revenue divisions. In fact, the irrigation requirements gave plenty of employment to the agricultural labourers, and very often the Executive Engineers could not get sufficient hands to carry out their extensions and repairs.

2. There was only one construction division in existence in 1896-97, *i.e.*, the Fatehpur Division. One escape was, however, dug under the Famine Rules, but of course the excavation of the main line provided a great deal of useful labour, which was paid for under the ordinary contract system.

3. In Bundelkhand, I believe, some tanks were made by the Buildings and Roads Branch under the supervision of Mr. Palmer; but this Department knows nothing about them, and they were never made over to it.

Note on paragraphs I and II of Memo. of Points to be considered by the Irrigation Commission.

Want of funds has very seldom led to useful works being kept in abeyance except in critical times, such as war, pestilence, or famine.

My own experience is that, if the Chief Engineer is strongly in favour of projects, and if they are well prepared, the money can generally be found.

2. The main bars to progress of work have been—

(*a*) want of projects;

(*b*) want of establishment.

As regards (*a*), I may say that great uneasiness was created some four or five years ago by some officers suffering pecuniarily on account of revised estimates or on account of sanctioned sums being exceeded. No doubt strict enquiries were made, and no doubt some errors of omission and commission came to light, and led the Lieutenant-Governor to consider it was right to punish the offenders; but the effect was very pernicious, as the faults were such as might have been dealt with more mildly, and many officers considered it was safer to do nothing than to be zealous, push on schemes, and then probably get into trouble. The Irrigation officer has frequently to accept grave responsibility, and incur expenditure in anticipation of sanction. But, when cases were reported of men being mulcted for such action, the natural result was to suppress zest and keenness to the detriment of Government interests.

I may say that this feeling is now passing away, but it is not easy to rub out such apprehensions when once excited in the rank and file of a big department.

3. The want of establishment is an important question and is no doubt well understood by Government. I think perhaps no branch of the Public Works Department is suffering from it more than in the United Provinces Irrigation. The reasons are due more to the losses we have suffered than to want of recruitment.

These losses are bound to increase, as unfortunately the nature of the work has got the reputation of being more unhealthy, more isolated, and more expensive than any other branches of the Public Works Department. The result is that, unless a man is a bachelor and very keen and very interested, he strains every point to get out of the Irrigation, although the work is so interesting.

4. For example, if we take the Railway Branch, a married man is saved a good deal of expense by being able to rail himself and his family free to the seaport or to the hills. On the sea, too, he gets special rates. Moreover, the Railway Engineer has many chances of deputation on guaranteed lines with extra pay, whereas in the Irrigation there is no outlet in Egypt.

5. Again, in the General Branch the Engineer has many chances of hill work, whereas there are practically none in the irrigation. Then the work of the former keeps a man mostly in a large town, where a house is found to be of use, and his family are contented. Granted that he has long distances of roads to inspect, but then it is possible to do this cheaply and quickly in a dogcart or on a bicycle. In the Irrigation the officer has to leave the station for months at a stretch, and is thus often compelled to keep up two establishments instead of one. In time this state of affairs leads frequently to domestic unhappiness, and very often to debt.

I can substantiate these remarks by enumerating six valuable officers who left the Irrigation during the last ten years, so as to avoid the isolation and expenses of work in the jungle. I may go further than this, and say that the same officers have benefited largely by the transfer.

6. In addition to the above, three picked men have gone to Egypt, two selected men have joined the Sanitary Department, four have been transferred to the General Branch, and now one of the best Assistants has obtained a Railway appointment.

7. It may be urged that this should not be allowed, but I think that such a restriction would be very unwise. A good officer should be allowed to get the value of his services, and if Government would reward the Irrigation Engineer according to his work, they would not lose him when his training and experience have rendered him valuable.

8. The remedial measures I propose are not expensive and are, I think, well deserved. Besides being an Engineer the Irrigation Officer has large revenue duties to perform, and therefore stands on a different basis from the Railway or General officer. Some of the divisions bring in a revenue of 7 or 8 lakhs, and yet the Engineer, who is responsible for it, gets nothing more than if he had ordinary engineering work to perform. I have gone through the mill myself, and know the amount of vernacular and statistical work that had to be done. Personally I liked it, and this revenue training was really the secret of any success I obtained in improving irrigation channels.

Some authorities have advised a separation of the work as in the Railway, where there are distinct Revenue and Engineering branches. But this is not sound, as the Irrigation Officer would quickly lose touch with the people, their cultivations, and, in fact, with the value of his work. My scheme is to pay the Divisional Engineer for this special work, and then the trained men will not be lost. The Sub-divisional Officer is an important factor in the Irrigation system, but generally his salary is good enough. All that is wanted in his case is to prove that the charge of a revenue division is a prize worth looking forward to, and will only be given to a trained and efficient officer.

Mr. H. Marsh.

20th Dec. 02.

9. The scheme I propose is that the Divisional Officer on a running canal should get, in addition to his grade pay, a house rent free and a charge allowance of Rs. 100 to Rs. 200 a month. There are at present 16 revenue divisions in the United Provinces Irrigation; so the annual cost of the concession would not exceed Rs. 40,000. This is an absolute trifle compared to the revenue for which these 16 officers are responsible, and which varies between 70 and 100 lakhs. Even that large sum is itself small when pitted against the value of the crops raised and the protection afforded to the Provinces.

10. Colonel Corbett, R.E., who served in this Province for thirty-one years, and who lived the jungle life of a canal officer for a longer period than most men, used to say that in some charges a thoroughly efficient Sub divisional Officer could raise the annual revenue secured by a merely ordinary predecessor by half a lakh. In other words, a keen, zealous, trained Assistant was worth Rs. 50,000 to Government, and of course ten times that amount to the irrigating community of his sub-division. Now in a canal division there are generally three Sub-divisional Officers, and, considering that fact in connection with Colonel Corbett's theory, it is evident how necessary it is to retain trained men in the Department and to remunerate them properly.

11. In conclusion, I beg to point out that these establishment matters are brought forward under cover of paragraphs I and II of the Commission's Memorandum, because I see the members wish to discover what steps are necessary to develope Irrigation projects and what are necessary to remove obstructions to the prosecution of the same.

To my mind no reform will be so far-reaching as what I have sketched. It will make the Department worth serving in, and will prevent the exodus of trained officers, which has left the staff in a depleted condition.

Note No. C.-201, dated 21st March 1902, by H. Marsh Esq., C.I.E., Superintending Engineer, 3rd Circle, Irrigation Works, United Provinces of Agra and Oudh, on the distribution of water-supply between the Western and Eastern Jumna Canals.

In the newspaper report of the evidence taken by the Irrigation Commission at Delhi, it is stated that Mr. Mullaly, Superintending Engineer, recommended a redistribution of the Jumna water-supply.

Apparently that Officer considered the Western Jumna Canal should get a larger proportion than it does.

2. At present the Western Jumna receives twice the Volume of the Eastern Jumna, and before any decision is arrived at, I venture to submit that it would be well to see which canal makes the better use of its share.

In most years it would be difficult to do this, as partial showers of rain slacken demand on one side of the river, and then the surplus volume goes to the other side.

3. But in the cold weather of 1899-1900 there was a raging demand for *rabi* sowings and standing sugarcane, from September to January. During that time the river kept on falling, and throughout this important agricultural season its volume remained lower than it had ever been before.

Consequently every drop of water was eagerly utilized, and the share of each Province was jealously watched.

Here then we have an exact test of the utilization of supply.

	Rabi.	Sugarcane.	Total.
	Acres.	Acres.	Acres.
The Punjab Canal, (Western Jumna) irrigated .	314,705	73,167	387,872
The N.-W. P. Canal, (Eastern Jumna) irrigated .	167,345	63,362	230,707

If the Punjab Canal had utilized its double volume with the same efficiency as the N.-W. Provinces Canal, it should show an acreage of twice that of the latter.

In other words its area should be 461,414 acres instead of 387,872 acres.

Mr. H. Marsh.

26th Dec. 02.

These figures work out to a proportion of 100 to 84 and show that for a certain unit of volume the N.-W. P. Canal covered 100 acres to every 84 of the Punjab Canal.

During the last two years the Eastern Jumna Canal distributaries have been undergoing a process of remodelling which has no doubt improved its efficiency.

In the current year, 1901-02, its area and revenue will top all records, and I therefore think it will give even a better account of itself when a similar chance for comparison can be again instituted.

5. I may mention that two years ago I pointed out these facts to some of the Punjab Irrigation Engineers. Their defence was that the discrepancy was due to the fact that the distribution system of the Western Jumna was so much more widely carried out, and that it travelled over a thirstier country.

Against this argument may be brought forward paragraph 23 of Mr. Preston's Inspection Notes of the Eastern Jumna for March 1899. Mr. Preston thought the Eastern Jumna would be improved by extensions, and wrote as follows :—

"Experience on the Western Jumna Canal in the Punjab has shown that water can be made available, by an improvement of the duty if new channels are to be constructed, and it seems possible the same may be done also in the case of the Eastern Jumna Canal."

I am of the same opinion, and feel hopeful that the more extensions we carry out, the greater will be the economy obtained.

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1. *Q.* (*The President.*)—Do you generally approve of Mr. Barlow's proposals as given in his report ?—Generally I do approve of them.

2. *Q.* We have been in Bundelkhand and the opinion we formed there was that the Betwa Canal did its work extremely well, considering the amount of water in it; the only misfortune was that there was not far more water. We also noted that it was practically closed during the rains; but that if the *bundelas* in its vicinity could be induced to grow rice, there would be a large amount of water available for that crop. In a demi-official letter which I have sent to the Lieutenant-Governor we have said that it would be a good plan to establish an experimental form there to introduce rice. Do you agree with that ?—I am not hopeful that rice will succeed, but I think it is worth the experiment.

3. *Q.* Why are you not hopeful ?—You heard the evidence of the zilladar; he said that the people had never begun rice there; whether this is due to the constitution of the people or the character of the soil is not clear. Colonel Corbett, who was a friend of the cultivators got seed and tried to sow rice, but it came to nothing.

4. *Q.* Do you see any chance of employing water in the rains ?—No. Extra storage is the first thing I should press for; I have been doing what I can in this direction, but with my limited establishment I am rather handicapped.

5. *Q.* The Ken Canal project is with the Government of India ?—Yes.

6. *Q.* Do you know how it is getting on ?—We are utterly blocked by the Agent to the Governor-General in Central India; he has not given his consent to it and the Government of India say they cannot go on without his consent. I have written to Mr. Preston demi-officially on the subject.

7. *Q.* (*Sir Thomas Higham.*)—*A propos* of that, the alignment of the upper portion has not been finally fixed; it will depend greatly on the trial pits ?—Yes.

8. *Q.* (*The President.*)—What is the state of the Dassan project ?—A preliminary reconnaissance was made. I have not got a party to put on the project at present and am letting it lie over till there are more men.

9. *Q.* You could not have the Ken and Dassan going on side by side; you have not the labour; have you ?—I think labour will have to be introduced to carry on these projects.

10. *Q.* Are you favourably impressed with the Belan project as far as you have got with it ?—Yes, it is a rice country and wherever there is rice irrigation is of great use, the idea is that a rice country is always poor in the north-west.

11. *Q.* What about the Tons ?—It is hopeless, I think; the only thing is that it would be a very useful scheme to have ready for famine; we would have something to show for 20 to 30 lakhs of rupees; they spent that sum in the last famine and have nothing to show for it.

12. *Q.* But if there was the possibility of storage in the upper waters ?—The supply in the Tons is not bad, but the command is bad.

13. *Q.* I think you are of opinion, that the Sardah is a project, that it is not expedient to carry out ?—I think there are very fair grounds for going on with the inundation canal for Hardoi and Shahjehanpore to replenish the natural reservoirs when they fail.

14. *Q.* Would it be available for Shahjehanpore ?—Yes, the officer I have sent has orders to see to it.

15. *Q.* (*Sir Thomas Higham.*)—Have you got gauge records at Bambassa on the Sardah ?—No.

16. *Q.* Supposing there was a partial failure of the rains before September, would you open the canal ?—This country suffers as much from excess of floods as from drought, and it would be rather dangerous to begin before September, as the rain might fall and the canal do damage. I don't think there should be any difficulty about getting in water. The word "inundation" canal is a misnomer.

17. *Q.* (*The President.*)—Are any improvements in progress in Rohilkhand ?—Yes, in Rohilkhand there are a number of streams and a very clumsy form of irrigation with earthen *bunds*; we have been progressing there with masonry dams; this year we have had sanction for two projects costing about 3 lakhs altogether. Mr. Bull says he can make a *pakka bund* in the Kho river and is making a survey of it at present; that will make a great difference; with earthen *bunds* we lose the early rice, as the *bunds* are always swept away in the floods.

18. *Q.* (*The President.*)—Is there much water in the Kho river ?—There is a lot for the rice country; they have done 17,000 acres of *rabi* with it.

19. *Q.* Is extension possible ?—Extension is not so necessary as to make irrigation perfectly safe. 17,000 acres of irrigation in the district are very useful.

20. *Q.* One would like to double that if one could ?—Yes, no doubt. It might be possible to do more by going up the rivers.

21. *Q.* The Ramganga water does nothing ?—No; it is one of those giant rivers that it would be very expensive to tackle and you would get an uncertain return from it ?

22. *Q.* (*Mr. Muir-Mackenzie.*)—Why uncertain ?—It has an immense volume of water when you don't require it and none when you do; it is not a snow-fed river; the river I speak of borders on Bijnor.

23. *Q.* (*Sir Thomas Higham.*)—Have they suffered from floods along the line of the proposed inundation canal from the Sardah ?—We shan't know anything about that till the officer on duty there brings in his report.

24. *Q.* Mr. King says you cannot drain Oudh on account of flooding Jaunpur ?—There has been trouble in Jaunpur from floods. I am always very doubtful whether drainage increases floods; the effect of drainage is that it gets rid of surplus water between each storm of rain. The worst floods are caused in undrained countries, because the natural depressions are full when a heavy fall of rain occurs. Most of the mischief from floods has come from the cyclone in August and September falling on undrained swamps.

25. *Q.* Are there any gauges at Jaunpur ?—Yes. There was a regular enquiry two or three years ago when the Buildings and Roads Branch put special officers, Mr. Parsanah and Mr. Gale, to report about it. Mr. Odling reviewed the report.

26. *Q.* Have you gone into the question of the Ramganga project ?—Very slightly; I don't know much about it.

27. *Q.* One reason for hanging that up was that the supply in the Ganges would not be sufficient; that is, for the Eastern Ganges; that difficulty would not occur in the case of a canal from the Ramganga ?—I think it would; it is not a snow-fed river.

28. *Q.* There is plenty of water in the river?—No, I may be wrong, but my idea is that it is one of those rivers that has a big flood in the rains and would require expensive head-works and that it falls to a very small ebb in the cold weather.

29. *Q.* Are there any records?—There must be old ones. There was a great turn in 1869 for utilizing these rivers and gauges were maintained. I dare say we could get something out of them.

30. *Q.* There has been nothing done since 1869?—I don't think so. Lord Mayo was keen about these projects, but Lord Northbrook, I believe, stopped them; he decided to have only paying canals.

31. *Q.* Are there any gauges kept on these rivers?—Not now.

32. *Q.* In Moradabad?—My Department does not keep them; I doubt if the Roads and Buildings Branch do. We have gauges on the Ken, Karamnassa, Tons and Belan only.

33. *Q.* Supposing the Ken Canal is sanctioned, you won't be able to take up the other projects, the Dassan, Belan and Tons?—I gather Government are making special efforts to recruit staff; if we have sufficient staff, we can do them.

34. *Q.* But as matters stand?—In 17 divisions and 45 sub-divisions I have only 6 Imperial Assistant Engineers; 2 just joined and 2 European Roorkee men.

35. *Q.* What is your cadre?—Fifty-four, I think.

36. *Q.* Are there any further extensions proposed for the Ganges Canal?—Yes, minors are to be made and new distributaries.

37. *Q.* Mr. Ivens said yesterday, as regards West Aligarh, that there was not enough water; do you agree?—No, I don't follow him there.

38. *Q.* Do you think the tract is one that requires irrigation?—It requires irrigation, but there is a good deal of bad soil, and I am not prepared to say that it is worth it.

39. *Q.* If it is worth it, do you think you could get water for it?—I think so. We have too much water generally in October and November; in December it begins to get scarce and is worse in January if there are no winter rains.

40. *Q.* You have plenty of water in October for extensions, but would you have water to mature all the crops you could give water to them?—We must reckon on the chance of good rain about Christmas. Agriculture all over the world depends on the weather; we cannot make irrigation so certain as to protect the crops if there is no rainfall. On the Eastern Jumna Canal we had 180,000 acres on hand and the discharge fell to 500 cubic feet; some of the fields were saved by dampness; others were a poor class of crop that required only one watering.

41. *Q.* When do you remit the water-rate?—When the crop is under 25 per cent.

42. *Q.* Which was your maximum year on the Eastern Jumna?—Last year.

43. *Q.* You didn't remit much then?—Very little.

44. *Q.* (*Mr. Muir-Mackenzie.*)—In 1896-97 did you give large remissions?—There were some.

45. *Q.* Have you any experience of a year in which the winter rains completely failed?—Last year was the worst we have ever had.

46. *Q.* (*Sir Thomas Higham.*)—Would it be possible to run an inundation canal from the Eastern Ganges?—Yes, I think so.

47. *Q.* Where would it take off?—Just below Hardwar.

48. *Q.* Could that be run on temporary head-works?—I think so, by helping it with spurs; there is a very heavy drop in the river.

49. *Q.* It has a sandy bottom?—It has small boulders for some miles below Hardwar.

50. *Q.* When do you begin your *bunds* at Hardwar?—That is a debatable point. In 1896-97, when I was Executive Engineer, I began early in September; this year we did not begin till well into October; the floods were too heavy.

51. *Q.* How long does it take to make them?—It takes a long time to complete them. We keep increasing our discharge daily, as the boulders rise in the cribs. Mr. Nethersole has started an experiment by which he proposes merely to give the cribs proper stability with a basis of boulders and then use a needle dam with the bamboos that grow along the canal bank.

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52. *Q.* How much do you spend a year on temporary *bund*?—Rs. 35,000. I think we have the cheapest head-works almost in India.

53. *Q.* You have a *pakka* escape at Mayapur?—Yes, and another at Hardwar.

54. *Q.* (*Mr. Muir-Mackenzie.*)—Are you in favour of the Irrigation Department making any extensions of small tanks in Jhansi and Lalitpur?—I think there is a good deal to be done in that way.

55. *Q.* Would you like to see the country properly surveyed?—Yes.

56. *Q.* With regard to the Sardah Canal, your view is that an inundation scheme should be tried before any final decision is come to?—Yes, I am always in favour of making a scheme tentatively.

57. *Q.* You would not finally condemn the Sardah till that has been tried?—No.

58. *Q.* I see in Oudh in the districts, which would be covered by the Sardah, there is an enormous area of rice cultivation; is the greater part of the area which is irrigated from *jhils* rice?—I don't know Oudh well enough to say.

59. *Q.* If the Sardah Canal were made, would it improve rice very much?—Rice is a very perishable crop, and if you have a supply of water for it, it must be a god-send.

60. *Q.* If water is provided, is there a fair likelihood of its being taken?—I think so.

61. *Q.* Mr. King in his report on the Sardah Canal gets out different set of levels from those of the earlier officer, and the conclusion appears to have been drawn from that that the spring level has risen; do you think that a safe conclusion?—I think that is most unaccountable, because the level should have been extremely low when King's levels were taken.

62. *Q.* When were they taken?—In the cold weather of 1896-97 when every well in the country was working.

63. *Q.* Don't you think the drop in the levels does not take place till the year following a dry year?—No; it decreases very quickly.

64. *Q.* It has been found in other parts of India that sub-soil water was abundant in that year, and that the drought was occasioned not so much by any deficiency in the total rainfall as by its early cessation?—I have had a great deal to do with spring levels and found different statements made with regard to them.

65. *Q.* In order to obtain reliable data you require much more careful observations than these?—Yes.

66. *Q.* (*Mr. Roberts.*)—What are the rules for measuring spring levels?—You require a well that is not used for irrigation and one with a good supply in it and you should measure from fixed marks.

67. *Q.* (*Mr. Muir-Mackenzie.*)—What is necessary is investigation extending over a series of years?—Yes, and a very careful selection of wells.

68. *Q.* In Rohilkhand, if it were possible to get a big canal into the country, would it benefit it very much?—I should not recommend it till the small distributaries were developed.

69. *Q.* Are there considerable parts of Rohilkhand that could never be reached by any system?—I don't think so.

70. *Q.* Mr. Alexander said that there were?—My business has brought me mostly into irrigated tracts; I cannot speak on that point.

71. *Q.* In Moradabad and Badaun?—I know practically nothing about those countries.

72. *Q.* One of Mr. Barlow's proposals is that the Irrigation Department should construct wells and take charge of well irrigation; do you approve of that?—No; I don't think we could tackle wells. We could help with field embankments but not wells.

73. *Q.* Could a well constructed by Government compare in cheapness with one constructed by a rayat?—Cheapness depends on the zamindar who has wood, stone and other materials rather than on labour.

74. *Q.* I understand you to say that for the saving of the crop you must depend on the occurrence of the winter rains, but I don't see how that agrees with what you say here in paragraph 11 of your note?—We cannot get a full crop without the help of the rains, though we can get a substantial crop. I was pressed last year to give water in October and November only to such fields as would be sure of a second and third watering. I said the country would rise against it.

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75. *Q.* Your refusing to give a supply at that time would not give you a larger supply later ?—No.

76. *Q.* There is a suggestion in Mr. Webbe's paper that if you are unable to give a second and third watering, you should make a remission; what do you think of that ?—So we do remit if the crop fails.

77. *Q.* That meets the case ?—Yes.

78. *Q.* (*Mr. Roberts.*)—Mr. Webbe in his paper complains of the way in which Deputy Magistrates are appointed; what is the system ?—He is generally a man who rises from *amin* or zilladar and for long service and distinguished merit becomes a Deputy Magistrate. I think the institution of Deputy Magistrates is perhaps the most wise part of our canal administration. His pay of Rs 200 to Rs. 400 is good enough to keep him from stooping to extortion; he is generally above suspicion.

79. *Q.* Mr. Webbe says in his paper—"Another blot in canal administration is the promotion of Deputy Magistrates from the ranks of zilladars, these in turn being recruited from the overseers and *amins*." That is correct ?—Yes.

80. *Q.* He goes on to say as follows:—"Whatever the individual exceptions of sturdy integrity (and there are some) it is most inadvisable that men, who have graduated through the lower grades of office and have either participated in extortion or been necessarily cognizant of the same by fellow subordinates, should be promoted to high office of Magistrates for the trial and decision of cases in which fellow subordinates are prosecutors or accused and the agriculturist the accused or complainants. What guarantee can there possibly be when departmental bias and training are all in the direction of concealment of departmental abuses and when departmental and Magistrate are one and the same." That is his indictment ?—I should strongly oppose any change in the present system. The Deputy Magistrate has always been my right-hand man; he is the most trusty native official we have and we always treat him with great respect. The appointment of Deputy Magistrate is the goal our men have in front of them, and it keeps them more straight than anything. This is one of the wisest institutions Government have made.

(*The President.*)—I agree with every word of that.

81. *Q.* (*Sir Thomas Higham.*)—He is called a Deputy Magistrate, but I fancy the actual magisterial and criminal work he does is very small ?—It is nothing; he is altogether employed on revenue work. Deputy Magistrates helped in the economy of water which has been effected. They made maps and worked with the greatest integrity and pluck; it was through them that we got rid of the blot of *tatils* and corruption.

82. *Q.* How many criminal cases do they have coming up ?—One or two cases every month for each man; in the old days I have known a Deputy Magistrate having 600 to 700 cases. Now he is employed in the distribution of water and checking the measurement of subordinates, etc.

83. *Q.* (*Mr. Muir-Mackenzie.*)—Mr. Webbe says in his paper—"The new system of irrigation with reduced apertures *plus* abolition of *tatils* will contribute still further to reduce subordinate *zulam*: provided (*a*) that tampering with and diminishing the water-supply at the head of distributary and falls is prevented; (*b*) that interference with *oosars* or sequence of irrigation officially prescribed for the agriculturist from each aperture, or their derangement by chowikdars, zilladars and overseers is suitably punished. Is there anything in that ?—No doubt some supervision is required. My staff is not good enough; we want a larger European element in it.

84. *Q.* (*Sir Thomas Higham.*)—Do you prefer to employ European or Native upper subordinates ?—I like a Native. If he is a good man, he is put into a sub-division and that is great prize for him.

85. *Q.* As regards the distribution of water between the Eastern and Western Jumna Canals, you say since the improvements there has been a very much higher duty on the Eastern Jumna Canal than before; what do you do with the water saved ?—This has only been going on in the last two years. One use of the water saved is that fields that used only to get water at the tail of the distributary in the beginning of the *fasl* are now as well off as those at the head. Another thing is that we are making minors to carry out water further afield.

86. *Q.* Are you taking up new villages ? Are they being admitted to irrigation ?—In a few cases. It was only begun when I went to the Eastern Jumna in 1898. Water will escape now into the Jumna and go to the Agra Canal; this is the chief advantage gained. We have escapes the whole way down into the Jumna and Hindan.

87. *Q.* How much goes from the Eastern Jumna to the Agra Canal ?—All the distributaries tail into drains; we have drained the Eastern Jumna thoroughly.

88. *Q.* What becomes of the water ?—It is caught in the Hindan and Jumna; the Hindan discharge is improved greatly; it was designed for only 200 cusecs, but now we hardly ever get less than 400 to 500 cusecs through it; this improvement is due to drains and escapes in the Ganges Canal and Eastern Jumna Canal.

89. *Q.* You say the duty in the United Provinces is 100 as compared with 84 in the Punjab; but, on the other side, they take water enormous distances; you have not allowed for that ?—I think it is quite clearly explained in the printed note.

90. *Q.* (*Mr. Muir-Mackenzie.*)—As regards the Sardah; in what way will an inundation canal be of use in testing the efficiency of the bigger project ?—The moment we fill the *jhils* the people will ask for water for direct irrigation; it is the usual way all big canals begin; the Jumna and Chenab began in this way.

91. *Q.* Will it test this matter of spring levels ?—I believe it won't affect spring levels very much if we don't stop well irrigation; if we check well irrigation the spring level will come up at once.

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WITNESS No. 58.—Mr. W. H. RUSHTON, Executive Engineer, Agra Canal.

Note, dated the 12th September 1902.

i. The first thing done here before arranging for distribution of water from a recently constructed channel is to make a copy of the village map on a scale of 16 inches to the mile showing fields and the area commanded by the distributary.

ii. Suitable points on the distributary are next determined, from which the areas can most conveniently be irrigated.

iii. Areas are next decided upon to be irrigated from each point, and suitable diameters of outlet pipes for each area are assigned.

iv. Finally, where necessary, a list is made of the fields to be watered by each outlet and an *oosrabandi* is drawn up giving to each cultivator portions of the seven irrigating days of the week, proportional to the area of his holding; due consideration being given to conditions of "flow" or "lift" and to the distance of the holding from the outlet head.

2. When deciding (iii) it is advisable not to allow water from any outlet to be carried across a road or much used path.

3. It also leads to less friction among cultivators, if care is taken, to give separate outlets for separate villages. This however is not always possible, and when not possible it is advisable always to draw up the *oosrabandi* as laid down in (iv).

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1. *Q.* (*The President.*)—You are Executive Engineer of the Agra Canal ?—Yes.

2 *Q.* You have the whole of the canal from end to end ?—I have from Ghaziabad the whole of the Hindan cut to about 40 miles the other side of Agra. The division is 150 miles long. I have five Sub-divisions under me.

3. *Q.* How many Assistant Engineers have you ?—Two, besides one Honorary Assistant Engineer, one Sub-Engineer, 2nd grade, Conductor Lee, and one native Overseer on Rs. 100 a month. Of the two European Assistant Engineers, one is in charge of the new Nandgaon distributary, which we have just started irrigating from

and the other is in charge of the new arterial drain which we have just commenced.

4. *Q.* How long have you held this charge?—A little over a year.

5. *Q.* Where were you before?—In the Etawah Division.

6. *Q.* What is the area altogether irrigated from the Agra canal now?—It might do a lakh and ninety thousand in *rabi* perhaps. I have got last year's figures here which show 110,694 acres of *kharif* and 150,033 acres of *rabi*. The green line in this diagram (shown to the President) describes graphically month by month the area irrigated. The blue shows the water in cusecs received. We had great difficulty in keeping all the irrigated crops alive last February when supply dropped to below 900 cusecs.

7. *Q.* What is the reason of this drop?—There was no water in the Jumna, and the Ganges canal required all the water they could take, so I got very little from the Hindan cut.

8. *Q.* Then altogether you have got up to about 300,000 in two *fasls*?—The biggest area that was ever done was 308,000 in the year.

9. *Q.* Is your *kharif* increasing?—I have made a little table shewing what the increase has been lately. This (shown) gives it to you. This is for the five years before the remodelling began and this is for the last two years. Before the remodelling it was 142,000 and now it is 217,000.

10. *Q.* (*Mr. Muir-Mackenzie.*)—You attribute the difference to what?—To the remodelling.

11. *Q.* (*The President.*)—Your *rabi* is very fluctuating?—Yes, here is a list showing a number of villages that never had any irrigation before the remodelling and giving the areas in them to which we have been giving irrigation lately. The canal has been remodelled and you can see from this list the difference in discharges which distributaries are now capable of carrying as compared with what they could carry before they were remodelled. The capacity has largely increased.

12. *Q.* Your supply from the Jani is a very important part of your asset?—Yes. We sometimes run down to 200 cusecs in the Jumna and sometimes less, and without the Jani supply we would have to stop work altogether.

13. *Q.* There is a proposal to divide your division into two; is not there?—Yes, and I think it a very good one indeed. I don't think it is possible for one man to do anything like justice to so large a canal division.

14. *Q.* I suppose you had not to contend with badly aligned distributaries in the canal?—The alignment, as far as I know, is good; the capacity was insufficient.

15. *Q.* That is insufficient according to the present system?—Every distributary was heavily *tatilled* and that led to all kinds of mismanagement, though I think our patrols are an excellent system; I don't see how we could get along without them.

16. *Q.* Have you had trouble with water-logging on the Agra Canal?—Last year there was a good deal of percolation about, but I was surprised to find so little this year, in spite of our having opened the canal for navigation purposes much sooner than usual.

17. *Q.* From the distributaries have you limited the irrigation in each village to a certain percentage?—For the new distributary we have just begun to irrigate from, it was arranged that not more than 40 per cent. of each village should be irrigated, and we hope to spend the 200 cusecs of water, so that not more than 40 per cent. of each village shall be irrigated.

18. *Q.* (*Sir Thomas Higham.*)—Forty per cent. of the cultivated area?—Forty per cent. of the cultivable area, excluding area now irrigated from wells.

19. *Q.* (*The President.*)—In the older villages, where the irrigation is going on for some years, is that pretty well preserved, or do they run to a much higher figure?—I have seen as much as 130 per cent. of the cultivable area of a village irrigated in the year?—I mean double cropping. That is a great deal too much.

20. *Q.* Have you never tried to reduce that?—The only way to reduce it, as far as I can see, is to give more water at the tails and reduce the number of outlets at the head reaches.

21. *Q.* Not reducing the size of the outlets?—No. I think it is a great mistake to reduce the size of outlets. The proper method, I think, is to make out how much area you intend to irrigate, give outlets at the very best places you can possibly give them, for this purpose and make your distributary carry the amount of water to satisfy all, run your distributary for a week, then shut it up and go on somewhere else, but you must fix the area to be irrigated. For a 6-inch outlet let it be 60 acres or let it be 80 acres according to the nature of the soil. Where there is *bhur* and light soil I would give them a somewhat larger outlet, because there is a great deal more waste of water.

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22. *Q.* But you must have some limit?—I should limit it to 100 acres for a 6-inch outlet.

23. *Q.* If a man wanted to work a smaller block than 60 acres, would you still give him an outlet?—Yes. There are village roads and these ought to be natural boundaries of the *chak* for which you give an outlet. The water should not be allowed to go across a village road. It causes a great deal of waste of water. I would give them outlets, so that they can quickly irrigate that *chak*.

24. *Q.* Some of your *chaks* would be under-irrigated by a 6-inch outlet and some of them would be over-irrigated; would not they?—They are not all of the same size. That is true, but the idea is always to give ample outlet so that there shall be no delay in getting the water on.

25. *Q.* (*The President.*)—Practically you have had a case where 130 per cent. of the area was irrigated. Have you tried to reduce that?—No, it is not fair to stop irrigation of fields that have a right to it. But where a village is over-irrigated there is usually waste of water. A watercourse irrigating such an area should be looked after, promptly closed when out of repair and not re-opened till it has been put into very good order.

26. *Q.* (*Sir Thomas Higham.*)—That would not reduce the supply; would it?—Yes, by reducing water-logging, percolation, careless spilling and wasting of water and by encouraging a more economical use of water on each field.

27. *Q.* If it was worth the while of that man to go on irrigating 120 per cent., he would not stick at putting his outlet right?—I don't see how you can stop a man from irrigating once he has got his water-rights. But, by forcing him to spend some labour in keeping his watercourse in good order we may bring home to him the value of the water he uses and try to make him irrigate as carefully as he does when he has to lift his water from a well.

28. *Q.* (*The President.*)—But Mr. Marsh stopped them by taking away outlets altogether. I have a village map here and will show you the system of taking out outlets. (Explained on map.)

29. *Q.* (*Sir Thomas Higham.*)—Do you know anything about the rise of water in the wells on your canal?—I have not studied that, because I have not been here very long. I have only had one year here and I have spent much of my time over the new Nundgaon distributary.

30. *Q.* Do you take periodical measurements of the depth of the spring level?—The depth of water in each well is measured twice a year.

31. *Q.* What time in the year?—In the wet time and in the dry time of the year.

32. *Q.* How long has that been kept up?—Right away from the beginning of the canal, I fancy.

33. *Q.* Do you know what the general result has been?—The water must have risen, but I have not looked up that.

34. *Q.* Is the rise faster or higher close to the main canal or is the rise over the whole irrigated area?—There were complaints that the canal had caused the spring level to rise very high at a place called Chhata. That is in the middle of much irrigation and where the Kosi arterial drain will run through.

35. *Q.* Was the drainage obstructed there?—No, not by irrigation works, but the country obstructs its own drainage in a way. There are large hollows surrounded by ridges and then there are other large hollows—pot-holes, on a big scale.

36. *Q.* You are cutting these pot-holes?—The Agra Canal country has no regularly defined natural drainage lines; rainfall collects in large depressions, cannot run off, but gradually evaporates and gets absorbed into the soil, which is porous; canal water has, in places, raised the subsoil water level, so that at a time of unusually heavy rainfall the land remains longer flooded than formerly, owing to its reduced power of absorption caused by this rise of spring level.

37. *Q.* (*Mr. Roberts.*)—Yours is a navigable canal; isn't it?—Yes.

38. *Q.* Does the necessity of keeping the canal open for navigation restrict the supply of water which you could

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use for irrigation?—The rule has been never to run the Agra Canal, unless it is run for irrigation; the navigation has been allowed to slide.

39. *Q.* But this year you have had to do a lot of carriage of tents, etc., for the Delhi Darbar?—Yes, this year was an exceptional year.

40. *Q.* And you have had to keep water in the canal for that?—We began running the water this year long before we would have opened the canal if there had not been the Viceroy's tents to carry.

41. *Q.* Are the boats running on it now?—Yes.

42. *Q.* Does that require you to keep a certain amount of water in, which you might have let out for irrigation?—I should say not.

43. *Q.* Not even in this exceptional year?—No. We have plenty of water just now.

44. *Q.* (*Sir Thomas Higham.*)—You say the tail portion has been given up for navigation?—The tail portion of the navigation channel has been allowed to go into disuse. (Explained on map.)

45. *Q.* How do you get your traffic?—The traffic comes from Agra along this *pakka* road here (shown) and gets into the boats here, at Kakraita (shown on map).

46. *Q.* Are there any boats to go through into the Jumna?—Not now.

47. *Q.* Where does all the traffic come from?—Agra, Kosi, Palwal, Hodal and Delhi.

48. *Q.* What is the principal traffic?—It is a poor man's traffic really. I think grain and cotton are the chief articles.

49. Don't they carry Agra stone away in this may?—I have not seen any boat loads of Agra stone going up or down.

50. *Q.* Where do they get the Agra stone from?—It comes from Dholpur, Bhartpur, and other Native States. Navigation has never paid on this Agra canal. It paid in one year 1885-86 Rs. 353 over working expenses. For every other year the figures show a loss.

51. *Q.* And how do you arrange now with all the Viceroy's tents?—They were boated from Kakraita to Okhla and thence up the Western Jumna navigation channel to Delhi.

52. *Q.* Where do you get the boats from?—We have about 20 iron boats which we use for carriage of materials for Canal and Engineering purposes; but country boats made of wood belonging to private owners and contractors also ply on the Canal.

53. *Q.* There is a lock into the Jumna at Okhla which is always open and workable?—They don't go up to Delhi by Okhla, except when the Jumna is navigable, which it is not at present, there is not enough water now to float a boat. I would like to show on the map the tract of country served by the new Nundgaon distributary (explained on map). The Nundgaon distributary was started in February; it is now December and we have already irrigated 2,000 acres of *rabi* from it. It is a 2½-lakh estimate and we have already spent one lakh on it up to date. I think we will be able to irrigate up to 5,000 acres of *rabi* before the end of this season. The value to the country of the crops thus brought to maturity will be large: and the revenue earned by Government will be (5,000 acres at say Rs. 2-8 per acre) = Rs. 12,500, not a bad return on an expenditure of 1½ lakhs in the first year from commencement of work. The result is due to placing at my disposal an adequate staff under a smart Assistant Engineer. The usual conditions lately have been for works to be supervised by a small and half-starved staff, and I wish to suggest that good and quick work pays well and can be done when reliable and sufficient men of the right kind are employed under a competent English Assistant Engineer.

55. *Q.* What are you going to irrigate on this when it is completed?—I hope it will run up to 20,000 acres; it will probably go to 28,000 acres in years to come.

56. *Q.* *Rabi* or *rabi* and *kharif*?—In one *fasl*—*rabi*. The *kharif* will be separate, perhaps 14,000 in *kharif*.

57. *Q.* Where is the Kosi drain?—(Shown on map.)

58. *Q.* Can anything be done in enlarging these drains as a means of employing famine relief labour?—I don't think so.

59. *Q.* Are the drains large enough when you get very big floods?—I think our drains are large enough. The only drain that is not is this one down here (shown on map), but we can do nothing to it, because we would have to enlarge the syphon. In order to get over that we have made a cut into the canal.

60. *Q.* I see Mr. Webbe complains that the drains don't take away the water?—There is no complaint of that sort here. The drains we have made recently have all been done on a proper system.

61. *Q.* What run off do you allow for a mile?—I fancy it is 2 to 3 cusecs per square mile; this is considered sufficient because the soil is porous and absorbs a good deal of water.

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WITNESS No. 59.—MR. W. A. KINLOCH, Manager of Fargus, Skinner Estate.

1. *Q.* (*The President.*)—How long have you been Manager of Mr. Skinner's estate?—For the last eight years.

2. *Q.* You have a great deal of irrigation on it, I suppose?—Yes. We pay the canal Rs. 24,000 yearly.

3. *Q.* (*Sir Thomas Higham.*)—Have you any complaints about the canal irrigation?—No, I have got no complaints, but I can recommend a few reforms. I consider that the department is very under-manned and too much is expected of Assistant Engineers and Executive Engineers, more so the Assistant Engineer. For example, an Assistant Engineer is expected to look after 250 miles of irrigation channel, to say nothing of 50 miles of drainage cuts, and it is impossible for him to have any check on canal irrigation, besides doing his office work and silt clearances, repairs, buildings, etc.

4. *Q.* (*The President.*)—And from that over-work what are the evil consequences which you have found?—I fear that the revenue is not collected to the very last farthing owing to lack of supervision.

5. *Q.* (*Sir Thomas Higham.*)—You mean what there is concealed irrigation?—When there is no supervision, there must be concealed irrigation.

6. *Q.* (*The President.*)—Have you had this brought personally to your knowledge on a large scale about this revenue not being collected to the last farthing?—I have had no case in particular. I have questioned the cultivators, but it is not to their gain to say they have not been charged.

7. *Q.* Do you think there is much oppression of the cultivators from the subordinates trying to make money out of them by blackmail and that kind of thing?—When there was the *tatil* system, the canal *chaprasis* generally had a good harvest. It would be a mistake to imagine the harvest is a thing of the past. They can still make money, but not so much. He reports cultivators to the Deputy Magistrate for having spilt water (*abzai*) and through fear of being reported to the Deputy Magistrate, the cultivator gives him a slight contribution for not reporting him.

8. *Q.* Do you suppose they make large sums?—No. It is about five seers of grain per *fasl* per plough from each cultivator.

9. *Q.* Do you think that the *kashtkar* himself feels this as a burden to him?—No.

10. *Q.* He is too much used to it?—Yes. He gets his money's worth back from the canal peon and he looks upon it merely as an established *huq*.

11. *Q.* Do you hear complaints of the integrity of the Native Deputy Magistrates?—I have not heard any complaints, but it is a mistake, in my opinion, having *abzai* cases tried by Canal Deputy Magistrates, because the cultivators, when fined, are too afraid to appeal against it, whether the punishment is just or unjust, for fear of the department being hard on them.

12. *Q.* Are there many such cases? The Chief Engineer said there were about two or three in the month?—Of course I am not up in statistics, so I could not tell you how many cases occur.

13. *Q.* Is a heavy fine inflicted as a rule?—It is a nominal fine; sometimes Rs. 5 or Rs. 10.

14. *Q.* (*Sir Thomas Higham.*)—Is it a fine or charge on the area?—He has got to pay for this waste of water.

(*The President.*)—My recollection is that it was double the area flooded.

(*Sir Thomas Higham.*)—What is the rule?

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(*The Secretary.*)—You charge the double rate if the land is cultivated and you charge the highest occupiers' rate if the land is not cultivated.

18. *Q.* (*Sir Thomas Higham.*)—Would you recommend that no charges should be made for water?—Certainly not.

19. *Q.* It is an evil?—It is. I have a very feasible proposal by which the canal revenues can be increased and that is by slightly reducing the rates for lift irrigation. At present the rates for flow irrigation are Rs. 1-14 a *pakka bigha* and those of lift, are 15 annas; that is exactly half. A man who takes the flow irrigation takes no less than five times the quantity of water taken by the lift cultivation, and if lift irrigation was encouraged and the rates were slightly reduced, I feel certain lift irrigation would increase, because to irrigate a *pakka bigha* the cost by lift irrigation is 15 annas; so after the first watering the two men stand on an equal footing. He has paid 15 annas for his lift irrigation, that is, Rs. 1-14, which is the same rate as the flow irrigation, but he has no less than three or four waterings and for every other watering the man who takes lift water will be 15 annas out of pocket.

20. *Q.* Why? The man who takes a third watering for the *rabi* crop is paying Rs. 2-13 for the mere trouble of lifting water?—Yes. In the first watering it is equal and after that it will be a burden on him. There is no scope for increasing flow rates; that is sufficiently high. The Canal Department are deriving a bigger revenue by their irrigation than the zamindar is actually in receipt of from his occupancy tenants.

21. *Q.* Has the canal irrigation supplemented well irrigation which was there before?—It has considerably.

22. *Q.* Do the men go back to these wells?—No.

23. *Q.* Why not?—Out of 303 wells on our estate, 124 are now only worked, 105 are not worked and 74 are classed as wells in the villages for drinking purposes. That clearly shows that since the canal came they have ceased to work.

24. *Q.* (*Sir Thomas Higham.*)—Nearly half the wells have gone out of use?—Yes And as regards the water level, formerly the water from the surface averaged from 20 to 25 feet, but since the introduction of the canal I have taken the water level of several wells and I have found now they range from 8 to 12 feet.

25. *Q.* (*Mr. Roberts.*)—That is to the surface of the water?—Yes.

26. *Q.* Do you think mischief has occurred to the land on that account that there is water-logging and deterioration?—There is no doubt the introduction of the canal has heightened the surface of the water.

27. *Q.* Do you think that has been a harm in itself?—It has increased *reh* slightly.

28. *Q.* How long ago were those levels taken?—I took them in November.

29. *Q.* When was this 25 feet level taken?—That I have taken from hearsay; that I have from the old men of the villages.

30. *Q.* You say *reh* has appeared slightly—not much?—Not much.

31. *Q.* (*The President.*)—Are you on the Kalda distributary?—Yes, on the Kalda *rajbahas*.

32. *Q.* You have some drainage cuts thereabouts?—Yes, several.

33. *Q.* Do you think they are doing good?—They have done an immense lot of good.

34. *Q.* Do you suppose they have brought down the spring level again?—They have hardly had time to do it.

35. *Q.* Have you yourself known of any instance where the progress of *reh* has been arrested by drainage?—No, not yet.

36. *Q.* You must be in the way of hearing things from the *kashtkars*?—I have to be very intimate with them.

37. *Q.* Have you had complaints made of false measurements of fields being measured that are not irrigated?—A very few cases.

38. *Q.* Do you think in general you may say the people are fairly well contented with the irrigation?—Yes.

39. *Q.* Would it be recognised as an improvement if more was put in the hands of the tahsildar and his officials and taken away from the canal officers as regards measurement and distribution of water?—No. I have a proposal for checking canal measurements. The present procedure is that the Executive Engineer sends the Magistrate the canal *jamabundis*. There is a moharrir in the Collector's office who signs these and the Collector after signing them sends them on to the tahsildars who in their turn distribute them to the zamindars, but they are not compared in the Collector's office with the *patwaris'* papers.

40. *Q.* The papers are handed in by the amins?—Yes, to the Executive Engineer's office.

41. *Q.* The *patwari* has been present at the measurement?—He is supposed to have been.

43. *Q.* (*Mr. Roberts.*)—Does not he sign?—He certainly signs; but if he were present, why would there be all this discrepancy. We are constantly having to remit *apashi* dues. If the *patwari* had been present, why should there be all these discrepancies.

44. *Q.* You mean the civil *patwari*?—Yes, the village *patwari*.

45. *Q.* What is your proposal?—I say the mere fact of the Executive Engineer sending them to the Collector's office is tantamount to a farce, if they are not compared with revenue papers.

46. *Q.* What comparison do you want made?—To see whether the entries are correct entries.

47. *Q.* (*Sir Thomas Higham.*)—Do you mean to say, if the village *patwari* had been there, these mistakes would not have been made? The canal amin's measurements are much more correct than the village *patwari's*; are they not?—I am not in a position to say who can make them more correct.

48. *Q.* (*Mr. Roberts.*)—The *khasra* is the same for both the *patwari* and the canal amin; is not it?—Yes.

49. *Q.* Where does the discrepancy come in?—The *patwari* is supposed to send in a statement every year showing that so many *bighas* of wheat and so many of sugarcane, etc., have been irrigated; the canal amin has to record the same thing which is known on the canal *jamabundi*, but my meaning is that the canal *jamabundis* when they are sent to the Collector, before being given to the zamindars, should be compared with the statement the *patwari* furnishes to the Collector.

50. *Q.* (*Mr. Roberts.*)—But the *patwari* does not send in his proposal till late. These are discrepancies which occur; there is occasionally a difference in the entry of the cultivator's name. Is that your experience?—Yes, in names and in accounts also.

51. *Q.* Does not the *patwari* go with the amin?—He is supposed to go with the amin and get a certain allowance from Government. I believe it is Rs. 1-4 per 100 acres for being in attendance; but, as a matter of fact, he does not go.

52. *Q.* (*The President.*)—Have you any other suggestions to make to us?—There is one other point I would like to bring forward, and that is the false economy practised in the department. Sometimes it happens that a sub-overseer on Rs. 34 or Rs. 40 per month is given charge of a sub-division; it may be for a couple of months; it may be for six months, and that same subordinate has under him a zilladar on Rs. 100 a month. Is it possible, I ask, for that man on Rs. 100 to obey the orders of a man on Rs. 35?

53. *Q.* Does that take place sometimes?—It has happened.

(*The Secretary.*)—I have known it to occur in the case of a sub-overseer; the zilladar is put under him.

(*Witness.*)—I have known of a case of an illakadar holding temporary charge of one of the sub-divisions in the Bulandshahr Canal and having a zilladar under him. I could not tell you for what length of time he held charge. This matter was brought to my notice by an Assistant Engineer.

54. *Q.* (*The President.*)—I suppose you have knocked off indigo from your estate?—It is not sown even now.

55. *Q.* Are you substituting any *kharif* crop for it?—Sugarcane has increased and taken the place of indigo.

56. *Q.* Will that go on to a large extent?—The cultivation of sugarcane has almost doubled since indigo has died out.

57. *Q.* Is it anything like the area that indigo used to cover?—No, but it is the best thing that could have happened in the interests of the Canal Department, the indigo dying out and being replaced by sugarcane. The rates for indigo were Rs. 1-14 per *bigha*, whereas they came to be Rs. 4-2-8 per *bigha* for sugarcane.

58. *Q.* Is cotton taking the place of indigo?—No, I would not say so.

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59. *Q.* (*Sir Thomas Higham.*)—I don't quite understand what you were saying about the flow rates. You think they are too low?—The flow rates are sufficient; what I advocate is a reduction in the lift rates to encourage the cultivators to take it further.

60. *Q.* But there is not very much land to be irrigated by lift?—A very great deal.

61. *Q.* Most of the land commanded is commanded by flow?—A certain amount of the land is certainly commanded by *pakka bigha* flow in our estate; the flow irrigation is 9,600 and the lift is only 2,000.

62. *Q.* That is a very small proportion?—Yes, about one-fifth.

63. *Q.* Here you say it will cost 15 annas to lift, if they take a third watering?—It is Rs. 2-13 in labour only.

64. *Q.* And they have to pay 15 annas for the lift rate per *pakka bigha*, that is, Rs. 3-12?—Yes.

65. *Q.* And the flow rate is only Rs. 1-14; where does the rest go to, the difference between the Rs. 1-14 and Rs. 3-12?—The men who cultivate by lift have to pay Rs. 3-12 for their water and the men who cultivate by flow take a great deal more water and pay less.

66. *Q.* Your meaning is that there is a margin for further increase in the flow rate?—The flow rates, as they stand at present, aggregate Rs. 3-12 per *pakka bigha* during the year, that is, for the two *fasls*. The zamindar does not get that rent from an occupancy tenant during the whole year.

67. *Q.* Why should he get as much as the water rate?—I am simply giving you a comparison.

68. *Q.* The rents are not lower than before the canal came in?—They have been enhanced.

69. *Q.* Why cannot we enhance the flow rates?—It must also be understood that the man who has taken lift irrigation is very chary about going in for a second watering and he runs a chance of having his crop dry up.

70. *Q.* The flow man does not run that chance?—No.

71. *Q.* He is very much better off?—Yes.

72. *Q.* Then surely he can afford to pay more than that Rs. 1-14?—In my humble opinion it is sufficiently high.

73. *Q.* You think it is sufficiently high, because the total water-rate is more than the total rent?—Yes, that is my meaning.

74. *Q.* (*Mr. Muir-Mackenzie.*)—There are still about half the wells in operation on your estate notwithstanding the introduction of canal water?—The wells that are working now are half in number that is true, but they are working where there are no canals.

75. *Q.* Are they *kachcha* or *pakka*?—Mostly *pakka*.

76. *Q.* Have you made *pakka* wells for your people at all?—We have not in recent years, but most of these wells were made by the Skinner family years ago prior to the introduction of the canal.

77. *Q.* The tenants don't make any new wells?—They have in recent years.

78. *Q.* How do they get money for making the wells? Are they generally substantial enough to make them without borrowing?—The only men who will make wells are those who have surplus cash, and all the *takavis* in the world won't encourage them to make wells.

79. *Q.* You don't think if you provide a man with part of the cost he needs that will help him?—I don't think so. Two years ago when the rains failed we asked them if they would have *takavi*, but not a man would take it. Well-to-do tenant, as a rule, will sooner borrow money and even pay as far as 12 per cent. interest and spend that money on marriages, but they won't sink any wells. Only men who have surplus cash are the men who sink wells.

80. *Q.* We heard from a Collector yesterday that he got people to borrow Rs. 80,000 in the district?—I am speaking from experience on our estate.

81. *Q.* You say your people never make their wells out of borrowed money at all?—No.

82. *Q.* (*Mr. Roberts.*)—Are there any new wells out of that lot on your estate?—Out of this total there are many new wells.

83. *Q.* Within the last ten years were there many new wells made?—Within the last few years I should not think more than 20 at the outside—two wells a year.

84. *Q.* (*Mr. Muir-Mackenzie.*)—Have they been partly made to replace old wells?—Partly to replace old wells and some of them are new.

85. *Q.* What is the average life of a good *pakka* well?—I cannot say the average, but there are some wells now that have been worked for the last 50 years.

86. *Q.* Are there many wells which would last indefinitely if carefully looked after?—Yes, but only those wells made with brick and lime plastered inside.

87. *Q.* Would they ever make a well of that sort to carry only one bucket?—Wells made now are for two *laos* or four *laos*, and a *pakka* well costs from Rs. 300 to Rs. 400.

88. *Q.* For two *laos*?—Yes.

89. *Q.* (*The President.*)—Plastered inside, entirely *pakka*?—Yes.

90. *Q.* (*Mr. Muir-Mackenzie.*)—And that sort of well may be expected to last an indefinite number of years?—Yes.

91. *Q.* In those parts of your village where no irrigation is given do you know what the water level is?—I have not got it written down, but I have a very good idea. In some of our villages towards *gulaothi* side the water level there as far I as remember, is fully 30 feet from the surface.

92. *Q.* Is that on high ground?—No.

93. *Q.* How far is it from any canal? Is it quite far from the canal?—Miles, but this area that I am referring to now has a *nadi* about a mile away from it. These wells I am referring to now at which the water level is at present 30 feet from the surface are far too remote to have been influenced by the canal.

94. *Q.* (*The President.*)—Are they near the edge of the Kadir?—Yes.

95. *Q.* (*Mr. Muir-Mackenzie.*)—Have you any idea what these wells which were made by the Skinner people cost? I refer to the original wells were they made through the tenants?—No, Skinner capital.

96. *Q.* Have you any idea what they cost?—I have not an idea, but I know you could not build some of these wells under Rs. 500.

97. *Q.* I suppose they are very fine large wells?—You can work four buckets on them.

98. *Q.* Did they make their wells much the more cheaper than their tenants could make them?—No. I say a tenant can make them cheaper than the zamindars.

99. *Q.* Have the wells by increase of rent paid the money spent upon them?—I have not got figures. I could not speak with any certainty.

100. *Q.* Do you think they have?—I don't think so, because if they had paid they would have been continued.

101. *Q.* They were more a work of munificence, I suppose?—Yes.

102. *Q.* (*Mr. Rajaratna Mudaliar.*)—You said *pakka* wells can be constructed for about Rs. 400?—Rs. 300 to Rs. 400.

103. *Q.* Does that represent the cash payment alone, or does that include labour?—It includes everything.

104. *Q.* Exclusive of the labour of the rayats?—It includes the labour of the rayats, wood, lime, mortar, everything.

105. *Q.* How many acres would such a well of two *laos* irrigate during the whole year? I mean the total area that can be irrigated in a year, *kharif* and *rabi*?—A well like that can protect nine acres from famine. What I mean is that these very same bullocks would have to work in the plough also and do odd jobs. You cannot say, that the well cannot do more.

106. *Q.* The well can do more if you can get the bullocks?—Yes.

107. *Q.* Could your area be doubled if you had a separate pair of bullocks?—If you doubled the men and bullocks, you could double your acres.

(*The Secretary.*)—One *lao* can water in a day from 2 to 2½ *kachcha bighas*, a little short of a *pakka bigha*.

108. *Q.* (*Mr. Rajaratna Mudaliar.*)—If a tenant constructs a well, you don't enhance his rent?—No.

109. *Q.* Then why doesn't he construct more wells if he is certain of being exempted from enhancement?—He won't be exempted at the next settlement.

110. *Q.* He will have 40 years' exemption; won't he?—30 years is the period of settlement.

111. *Q.* And during the period of the current settlement he would have the benefit of that water?—Yes.

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112. *Q.* Is that not a strong inducement for him?—It is not a matter of inducements where the land is sufficiently well irrigated by canals. That is one of the reasons I can ascribe for wells not being made; secondly, if a cultivator has spare cash, he will spend it on a well; if he has not, he won't spend it and he will not take *takavi*.

113. *Q.* You said on canal irrigated lands the rents have been enhanced by the zamindars?—The rents have not only been enhanced on canal lands, but also on the well lands during the last settlement.

114. *Q.* Not by the zamindars independently of the settlement?—No. You see the Government enhanced the zamindars' revenue in the settlement of 1889, and the zamindars enhanced their tenants' rents.

115. *Q.* But the zamindar's revenue is fixed upon the actual rentals. If your rents have increased, the zamindar's rates must also have increased?—In the last settlement the revenue was fixed upon the existing rentals. On that the Government increase was 37 or 38 per cent. and Government then gave us leave to sue our tenants for a corresponding increase.

116 *Q.* If there had been no enhancement in that settlement, the zamindars would not have enhanced their tenants' rents?—Quite so.

117. *Q.* You said there were discrepancies between the canal officer's *jamabundis* and the *patwari's* figures. Have many cases of that kind come to your notice?—We are constantly having to refund money for these discrepancies.

118. *Q.* If the Canal Deputy Collector prepares his *jamabundi* in consultation with the *patwari*, could not these discrepancies be obviated?—Yes.

119. *Q.* What is the difficulty?—The difficulty is that the *patwari* is a man who only does the signing and never troubles about going with the amin to the spot. That is my grievance. At present the *patwari* has nothing to fear; he simply signs the *jamabundi* year after year. Punish the men once or twice and you will never have these discrepancies occur again.

120. *Q.* (*Mr. Roberts.*)—You remark that the flow rate was Rs. 1-14 a *pakka bigha* and Rs. 1-14 for the next *fasl*. Does any land do two *fasls* in the year?—Yes, indigo and wheat; we will say so.

121. *Q.* Does any land have two *fasli* crops in the year?—Yes, indigo and wheat.

122. *Q.* Does any cultivator irrigate the whole of his land twice in the year?—Not the whole area. I am taking Rs. 3-12 for an individual area.

123. *Q.* He would not be paying Rs. 3-12 to the Canal Department for his entire holding, because he would not be irrigating his holding twice?—No.

124. *Q.* Have you got any tenants paying only Rs. 3-12 rent?—There are many of our occupancy tenants not paying that.

125. *Q.* And your non-occupancy tenants what would they be paying?—Non-occupancy tenants pay Rs. 6 *pakka bigha*.

126. *Q.* In their case the zamindar is getting full rent?—Yes, but the majority of our tenants are occupancy tenants.

127. *Q.* What is the average rent of your occupancy tenants?—Roughly speaking, Rs. 3-8.

128. *Q.* What class of people are paying that?—No particular class.

129. *Q.* What have they been enhanced to now?—We cannot enhance on them.

130. *Q.* But you have?—By this new Act, no.

131. *Q.* Under the old Act what could you do?—Under the old Act we could not enhance.

132. *Q.* Have you tried?—Yes.

133. *Q.* My impression is that Rs. 3-12 is a very low rate in B for occupancy tenants. Why cannot you get it raised up to the rates other occupancy tenants are paying?—The Settlement Officer divided the areas into areas of like capacity and like soil and he made the rates all one.

134. *Q.* Now about lift and flow irrigation you pointed out that the lift man is at a disadvantage. Of course occupancy tenants will be paying the same rents, but in the case of non-occupancy tenant taking lift irrigation, does he pay you the same rent as a non-occupancy tenant taking flow?—Yes.

135. *Q.* That would seem to support Sir Thomas Higham's argument that there is room for enhancement all over?—Yes, but all his land is not lift irrigation.

136. *Q.* For the area under lift irrigation?—But he may only have a portion of the land under lift.

137. *Q.* (*Mr. Muir-Mackenzie.*)—I understood you to say that the rent of a tenant who had constructed a well was liable to enhancement at the new settlement?—Yes.

138. *Q.* Take the case of a non-canal irrigated track. Supposing he is paying dry rates at the current settlement, would he at the next settlement have his land raised to the wet rate?—Yes.

139. *Q.* Even although he were only paying the dry rate before?—Yes. At the next settlement for the fact of that well being there, he would have to pay the wet rate.

WITNESS NO. 60.—RAI BAHADUR NATHU MAL, of Khurja, District Bulandshahr.

Bahadur Nathu Mal.

20th Dec. 02.

(*To the President.*)—I want water for a village in Bulandshahr. There are wells in the village and the water is only 20 feet from the surface of ground, but when canal water comes the value of a village is quadrupled. There is plenty of scope for making more wells, but unless the zamindar and the tenant agree, no wells are made. Where a tenant is *maurusi*, the zamindar opposes the construction of a well on his land. A *pakka* well costs Rs. 600 for two buckets. There has been no damage in my parts from spring level rising; there is no doubt that drains are necessary in places. I remember times of great fever in Khurja, but there has been none since the drains were made. The Canal Department should take over the cultivator's *guls*. The zamindars and cultivators make them badly.

(*To Mr. Rajaratna Mudaliar.*)—My estate is in Aligarh, and is canal-irrigated. I have no complaint against the canal administration. If anything goes wrong, I bring it to notice and it is put right. The land used to be damaged by excessive irrigation, but this has been remedied by outlets having been reduced. Reduction of outlets has been made during the last four or five years. There are very few complaints of shortness of supply.

Memorandum of points to be considered by the Irrigation Commission in the United Provinces of Agra and Oudh, in amplification of certain points noted in the enclosure to Public Works Department letter No. 547 C. W. I., dated 7th May 1901 and in the printed "Questions for Revenue officers."

1. *Extension, etc., of existing Irrigation Works.*—Are many extensions or improvements of existing works which would be certain to prove remunerative or to increase the efficiency of the works, held in abeyance owing to restriction of funds?

2. *Financial arrangements.*—Have present arrangements under the provincial settlement the effect of encouraging or discouraging the extension of irrigation?

3. *Expansion of irrigation from existing works.*—Main features and results of the policy adopted during recent years for the expansion of irrigation from existing canals by remodelling the channels, readjusting the size and location of outlets, and improving generally the system of distribution. Further scope for similar improvements.

4. *Duty of water.*—Improvement effected of recent years in the duty of water. Probable percentages of supply at head of canals still lost by percolation, etc., from (1) Main Canal, (2) Distributaries, (3) Watercourses. Results of any experiments that may have been made with reference to the question of rendering the channels watertight by puddling or otherwise.

5. *Distribution of water.*—How is the distribution of water controlled and the share of each village and cultivator determined, more especially with reference to the more recently constructed channels.

6. *Index of protection-Protected and unprotected tracts.*—In the light of recent experience what is considered to be (1) the proportion of the average area annually sown which must be matured, and (2) the proportion of the normal *rabi* area which must be irrigated, to ensure a tract against famine. Situation, areas, and populations of districts or tracts which in the absence of artificial irrigation would be liable to suffer from drought; map of same. Proportion in each district or tract which the area irrigated in dry year bears to the normal rabi area. Mean annual rainfall of each district or tract. Years in which district or

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tract suffered from drought or would probably have suffered in the absence of irrigation; and the rainfall of each of these years.

7. *Storage works.*—The feasibility of holding over a sufficient supply from ordinary years so as to afford the fullest possible amount of protection to the crops in a year of drought. The following particulars in regard to one or two typical storage works:—

I.—Initial Statistics.—

1. Area and nature of catchment.
2. Average annual rainfall over catchment.
3. Full supply capacity of tank in million cubic feet.
4. Percentage of capacity on run-off due to total average rainfall.
5. Water-spread at full supply.
6. Total capital cost.
7. Scale of water rates.

II.—Annual Statistics for typical years.

1. Rainfall of year.
2. Amount stored during year.
3. Amount run over waste weir.
4. Total run-off for the year.
5. Percentage of run-off on total rainfall of year.
6. Area irrigated during the year in acres.
7. Quantity of water if any left in tank at end of irrigating season and available for next year.

8. ***Wells.***—A memorandum and statements (***vide*** form attached) showing of each district and province the number of wells *pakka, kachcha* and total), in use for irrigation during each of the past ten years; gross area of crops irrigated by the wells in each year; the average area of crops irrigated per well in (1) a specified normal year and (2) in a specified year of drought; the average depth from ground to water surface; the average cost of a pakka well; and of a *kachcha* well; the amount of takavi advanced in each year for the construction or repair of wells; the number of wells constructed or repaired by means of these advances. Districts in which the extension or security of cultivation must depend mainly on the construction of new wells.

9. ***Private irrigation works other than wells.***—Districts in which private irrigation works (including field embankments) exist. Brief description of such works and desirability and possibility of encouraging their further construction in certain districts.

10. *Black cotton soil.*—Usual depth of black cotton soils and nature of the underlying stratum. Extent to which the suitability of these soils for irrigation is affected by their depth and by the facilities for natural drainage afforded by the stratum underlying them. Average increase of produce due to the irrigation of the various descriptions of black soils, as shown by any crop cutting experiments that may have been made during recent years.

11 ***Flood protection and drainage works.***—Drainage of canal-irrigated districts; total expenditure incurred; and results obtained, beneficial and otherwise. Necessity for the further construction of drainage works in canal-irrigated and other districts.

12. ***Famine relief works.***—Total expenditure incurred on each class of relief works—Roads and road metalling, Railways, Irrigation Works Village tanks for water-supply, and Miscellaneous—in each of the districts affected by the famine of 1896-97. Works uncompleted at the end of the famine which it is considered desirable to complete as a charge against Imperial or Provincial revenues. Reasons for proposing their completion. Result attained on completed irrigation or storage works. Arrangements made for the control and maintenance of such works.

13. ***Famine relief*** *programmes.*—Districts for which programmes have and have not been prepared. Examination of programmes, especially those of districts most liable to famine, with reference to the number of units provided for, the distribution of the works over the district, and their utility. Maps of proposed works. Arrangements for maintaining, extending or completing the programmes.

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